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A TECHNIQUE FOR SEGMENTAL PULMONARY RESECTION WITH PARTICULAR REFERENCE TO LINGULECTOMY

O. THERON CLAGETT, M.D.,* AND RALPH A. DETERLING, JR., M.D.†
ROCHESTER, MINN.

HISTORY AND ANATOMY

IN VIEW of the rapid strides that have been made in thoracic surgery as a result of improvement in operative technique, anesthesia, and the antibiotic agents, the surgical treatment of pulmonary lesions has become less formidable each passing year. The one-stage pulmonary resection by individual ligation of pulmonary vessels and careful suture of the bronchus developed by Rienhoff and associates,[1, 2] Graham and Singer,[3] Mason,[4] Crafoord,[5] Churchill and Belsey,[6] Blades,[7] and Kent and Blades,[8-10] Sweet,[11] and others, has reduced the mortality rate tremendously, has lessened postoperative morbidity, and has diminished the incidence of bronchopleural fistulas.

The first successful lobectomy was performed by Heidenhain[12] in 1901. By 1925, approximately eighty-five cases of pulmonary resection had been recorded. Lilienthal reported a mortality rate of 60 per cent in his series of thirty-four cases. However, in the next decade the number of cases was greatly augmented and, in 1935, Graham, Singer, and Ballon[13] reviewed data on 212 cases of bronchiectasis in which lobectomy had been performed, and reported a surgical mortality rate of 34 per cent. Data on these cases were collected from the records of twenty-five surgeons, and 75 per cent of the operations were done in two or more stages. Dolley and Jones[14] have shown that in cases collected from 1929 to 1939 the mortality rate was about 18 per cent, whereas in cases analyzed from 1935 to 1939 the mortality rate reported by the various authors had dropped to from 2.6 to 11.0 per cent. It is similarly noteworthy that in the experience of the surgeons of the Mayo Clinic,[15] the present over-all

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*Division of Surgery, Mayo Clinic.
†Fellow in Surgery, Mayo Foundation.

surgical risk in cases of lobectomy for reasonably well-localized lesions has been between 3 and 5 per cent; this compares favorably with that of many less hazardous abdominal operations.

Although the value of pulmonary resection has become firmly established in the surgical treatment of pulmonary abscess and infected cyst, bronchial adenoma, bronchiogenic carcinoma, and even of pulmonary tuberculosis and solitary metastatic lesions, perhaps the widest application of pulmonary resection has been in cases of bronchiectasis. The seriousness of this condition has not been adequately realized, despite the fact that Laënnec first recognized and described the condition in 1819, and that the first lobectomy performed was for the disease.[16] Some degree of bronchiectasis has been reported in about 2 per cent of all cases in which necropsy has been performed at the Mayo Clinic. Early diagnosis is particularly urgent if surgical treatment is contemplated, and this is possible with the excellent roentgenographic visualization of the bronchial tree after the instillation of radiopaque oil, a technique introduced in 1922 by Sicard and Forestier. The ineffectiveness of conservative medical treatment, such as postural drainage or treatment with arsenical compounds, guaiacol, or sulfonamides, in preventing the progression of this serious disease places the responsibility of cure in properly selected cases on the shoulders of the thoracic surgeon. Even the early encouraging results of intratracheal instillations and nebulization of penicillin and streptomycin, in a series of cases at the Mayo Clinic,[17] do not warrant the adoption of this treatment as a substitute for surgical treatment in many cases.

Since few people who have definitely demonstrable bronchiectasis live to be more than 40 years of age, and since the greatest incidence of the disease is in the first decade of life, surgical treatment of this condition is carried out on a candidate who will tolerate a major operation better than one in the older age group and who frequently will show true hyperplasia of pulmonary tissue to help compensate for the removed segment of lung.[18, 19]

In 471 patients with proved bronchiectasis seen at the Mayo Clinic between Jan. 1, 1935, and Dec. 31, 1942, inclusive, the site of the involvement was tabulated in 202 cases. The right lower lobe was involved in 19 per cent of the cases, the left lower lobe in 35 per cent, and both lower lobes in 19 per cent. In relatively few cases were other lobes, or the entire lung, involved except those in which the lingula of the left upper lobe was concerned. This so-called homologue of the right middle lobe has a great tendency to involvement when the left lower lobe is diseased. In 1939 Churchill and Belsey,[6] in reviewing data on patients examined at the Massachusetts General Hospital, stated that "the lingula is also involved sufficiently to demand resection in at least 80 per cent of the cases of bronchiectasis of the left lower lobe, the most common site of the disease." Of eighty-six cases in which Churchill operated, the disease was limited to a single lobe in only 20 per cent. Of 108 cases of bronchiectasis of the left lower lobe in which operation was performed at Brompton Chest Hospital in London, the lingula was involved in 75 per cent. While the lingular involvement with bronchiectasis of the left lower lobe in surgical cases runs considerably less than 75 per cent at the Mayo Clinic, one

can readily recognize the importance of this small bronchus in cases in which curative surgical treatment is employed. It is little wonder that the results in some cases of lobectomy fall short of expectations, since the continuation of cough and sputum can often be attributed to residual disease in an unresected involved lingula. It has been due to recognition of this by Churchill and Belsey,[6, 20, 21] and to their dissemination of the concept of pulmonary bronchovascular segments that surgical resection of the lingular process has become a safe and feasible procedure.

It is our purpose to present a simple technique of lingulectomy which avoids surgical trauma to the remaining normally functioning pulmonary tissue, as well as the needless sacrifice of uninvolved lung. While this operation has been carried out primarily as an adjunct to left lower lobectomy for bronchiectasis, the technique may as easily be employed in simple lingulectomy for a localized process, or in segmental lobectomy where a portion of a lobe could reasonably be preserved. We have employed a slight modification of this technique successfully in one case of lobectomy in which no interlobar fissure was detectable. However, for a clear understanding of this method, a short review of the anatomy is in order.

In 1934 Nelson[22] suggested the division of each lung into four anatomic lobes on the basis of four distinct separate bronchovascular units, with occasionally demonstrable rudimentary fissures, constant in position and marking a relatively avascular plane to delineate upper, middle, lower, and dorsal (or apical) lobes. Likewise, Ewart[23] in 1889 described the lingular process as a "cardiac lobe," with details of the anatomy on the basis of dissections and bronchial casts. Hovelacque,[24] Chiari,[25] Monod,[26] and others have reported cases in which there was a separate lobe for the lingula on the left. Ordinarily, when a fissure is found, it is more prominent anteriorly than posteriorly but most often it is limited simply to a notch at the anterior costomediastinal edge. The lingular division of the left upper lobe can be well demarcated only rarely, and then resembles the right middle lobe in shape, the mediastinal surface being quadrilateral, the inferior being semielliptic, and the costal being triangular with a ridge or "frenum" separating the inferior and mediastinal surfaces, extending up and back to the hilus. In this latter structure posteriorly are the bronchus and blood vessels.

The lingular bronchus enters the inferior surface of the bronchus of the left upper lobe about 1 to 2 cm. from its origin and runs laterally, coursing downward and slightly anteriorly. Subdivisions into anterior and posterior branches develop about 2 to 3 cm. from the origin and these divide still further laterally. Many variations are encountered, mainly as to distance of origin from the orifice of the bronchus of the left upper lobe, although lingular and axillary bronchi may arise by a common stem from the bronchus of the left upper lobe. The lingular bronchus may rarely arise directly from the main left bronchus and we have seen one case in which it arose from the bronchus of the left lower lobe. As the accurate knowledge of the topography of this bronchus is most essential to successful lingulectomy, careful study of the bronchogram (Fig. 1) is imperative, with particular attention to the right

oblique bronchogram, which affords a profile view of this bronchus. In reviewing cases in which there are residual symptoms after left lower lobectomy, one must keep in mind (1) an unusually long lower lobe stump, (2) inflammatory stenosis of the left upper lobe or lingula secondary to an unusually short lower lobe stump, and (3) small bronchopleural fistula from the left lower lobe stump, because these conditions call for different treatment than does residual lingular bronchiectasis.

Fig. 1.—Left bronchogram taken in the right anterior oblique position to demonstrate lingular bronchiectasis.

The veins draining the lingular process course anteriorly to the bronchus, joining near the hilus into a main vessel still anterior and medial to the bronchus. This in turn drains into the inferior pulmonary vein. The arterial supply arises from the left main pulmonary vessel just above the site of origin of the bronchus of the left upper lobe and runs posterolaterally to this bronchus,

coursing downward in the same plane along the lingular bronchus from its origin. A clear graphic representation of the anatomic relations can be found in the excellent articles by Churchill and Belsey,[6] Kent and Blades,[10] and Boyden.[27]

PREOPERATIVE PREPARATION

When patients have suppurative pulmonary disease, it has been the practice at the Mayo Clinic to prepare them during several days in the hospital. When postural drainage is effective, it is carried out, especially in cases of

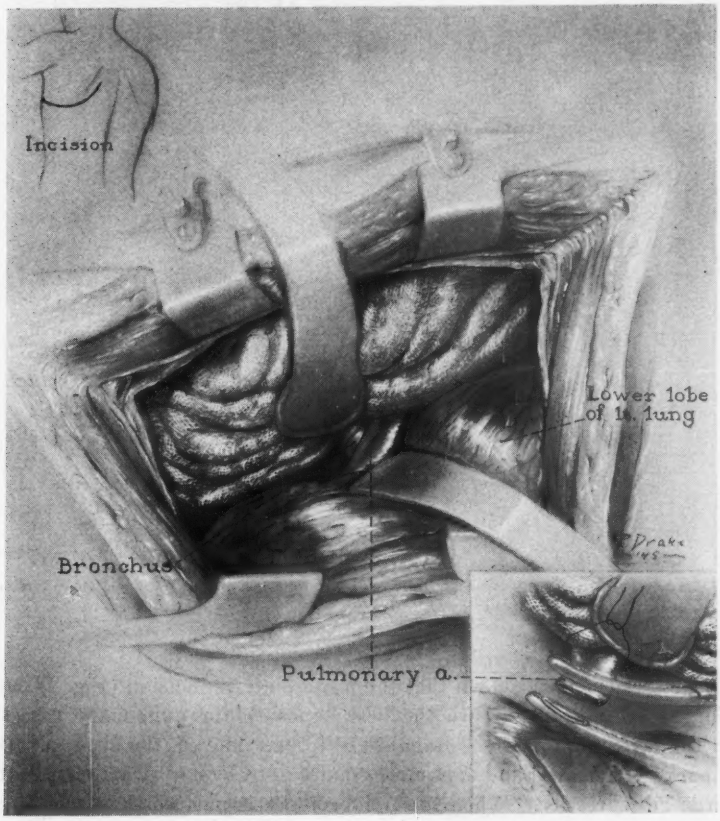

Fig. 2.—Exposure of the left inferior pulmonary artery. Insets illustrate usual posterolateral incision as well as division and individual ligation of the artery.

bronchiectasis. In these latter cases the patients are also given a three-to-seven-day course of penicillin (150,000 units daily) or streptomycin (500,000 units daily), or both, by nebulization[17, 28] in order to reduce the inflammatory reaction at the hilus, as well as the virulence and numbers of the organisms and the amount of bronchial secretions before operation. In many cases this is supplemented with intramuscular or supraglottic instillations of penicillin

or streptomycin, or both. It has not been necessary to employ tests of respiratory and ventilatory function when partial pneumonectomy is contemplated in an otherwise healthy young patient. Blood transfusions, vitamins, rest, and high caloric diet play an equally important role in preoperative preparation.

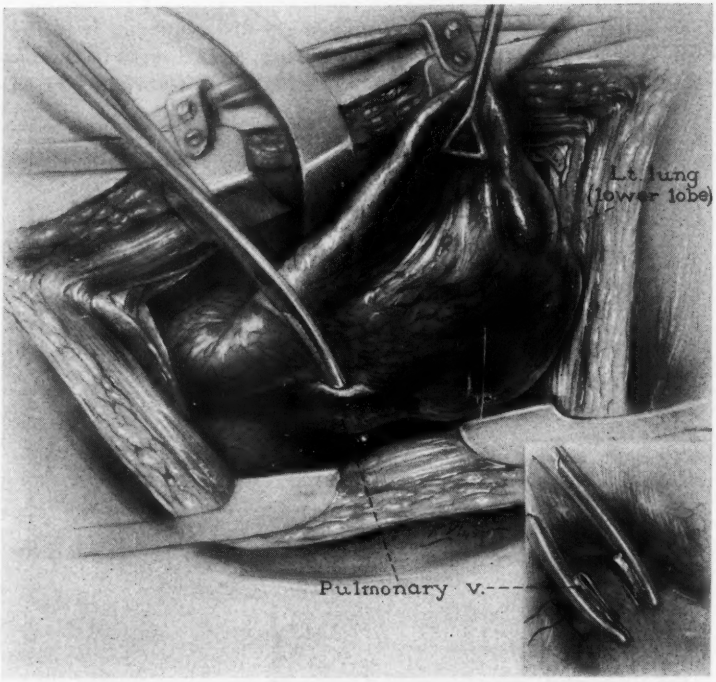

Fig. 3.—Exposure of the left inferior pulmonary vein. Inset demonstrates the division and individual ligation of the vessel.

OPERATIVE TECHNIQUE

Our experience has shown that the posterolateral incision (Fig. 2) curving inferior to the scapula allows the best exposure for pulmonary resection.[15] When the lower lobe and the lingula are to be removed, the sixth or seventh rib is partially removed and exposure is maintained by a self-retaining A. Tudor Edwards rib spreader. When lower lobectomy is part of the procedure, the hilar structures are partially freed by blunt dissection. The pulmonary artery to the lower lobe is identified, clamped, and divided (Fig. 2). All vessels are ligated once with No. 1 chromic catgut and then a transfixion suture is applied just distal to the ligature while the clamp is still in place. Next the pulmonary ligament is divided and ligated and the inferior pulmonary vein is identified (Fig. 3). With the ligation of the inferior pulmonary vein and the artery completed, the bronchus is divided and sutured after the method of Sweet[11] (Fig. 4).

After the hilar stump has been covered with pleura, the upper lobe is mobilized upward and laterally to expose the "frenum." Care should be exercised to identify the phrenic nerve where it passes anterior to the hilus and to avoid injury to it. By blunt dissection, pulmonary parenchyma is freed from the mediastinal pleura until the bronchus of the upper lobe and the attendant blood vessels are exposed. Where the lingular bronchus arises from the bronchus of the left upper lobe the vessels are ligated and divided. One should avoid injury to the artery of the left lower lobe if lobectomy has not

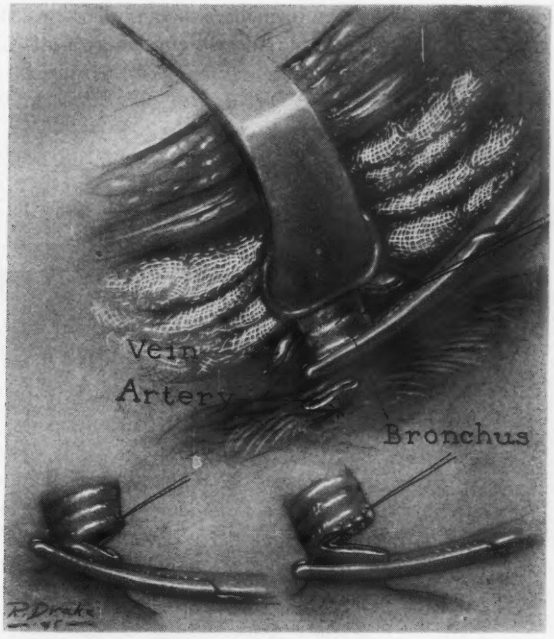

Fig. 4.—Steps in the closure of the bronchus.

been performed. The lingular bronchus is then mobilized (Fig. 5 *a*) and clamped lightly. The lung is inflated under positive pressure (8 to 10 mm. of mercury) to show integrity of the bronchus of the left upper lobe. After the lingular bronchus has been divided between clamps, the proximal stump is singly ligated but the clamp is left on the distal stump to serve for traction. By gentle pull on this clamp the lingular bronchus and lingular parenchyma are easily freed by blunt dissection along a rather avascular plane (Fig. 5 *b*). Thus is avoided the need for traumatizing clamps on cut pulmonary surface. If one pauses during this process of traction dissection to place simple interrupted plain catgut sutures in order to approximate the visceral pleura along the line of cleavage (Fig. 5 *c*), the oozing of blood and the danger of poor reexpansion of pulmonary tissue are further minimized. Despite the great

elasticity of pulmonary tissue, it is felt that a continuous suture reduces the degree of aeration along the line of resection, where it is particularly vital.

The threat of subsequent empyema is much less with this technique than with relatively blind clamping and cutting techniques, since the source of such spilling, the involved lingular bronchus, is kept under complete control in the axis of traction. With such direct observation, one likewise avoids the danger of bisecting one of the subdivisions. Finally, it is clear that the sacrifice of normally aerating pulmonary tissue is kept at an absolute minimum by this method. It should be evident that this technique of traction dissection along a plane of cleavage created by the bronchosvascular divisions is similarly applicable to partial pneumonectomy or to lobectomy where no fissure exists.

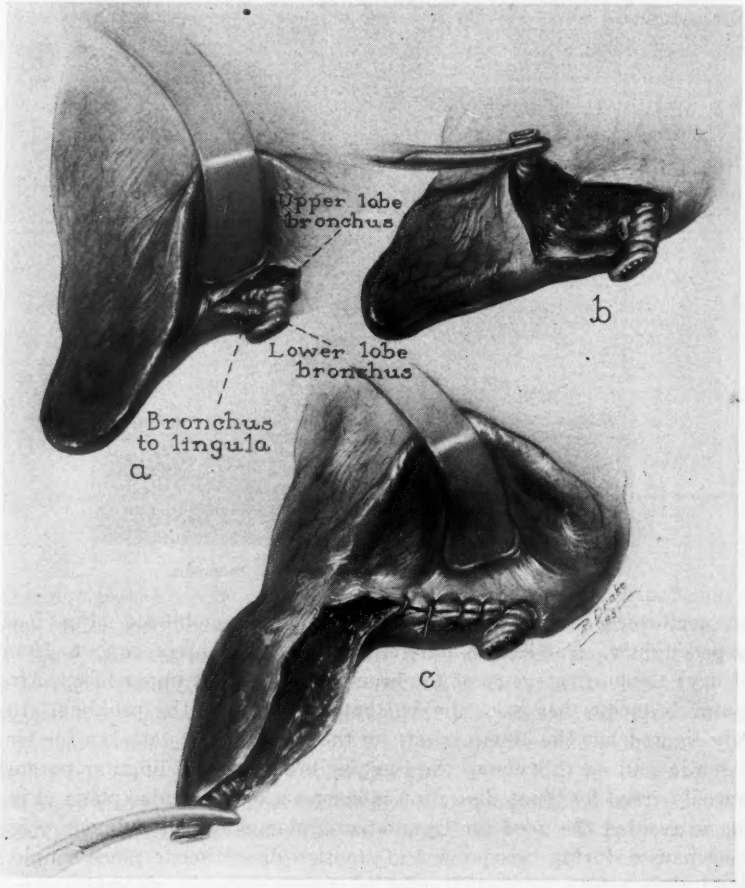

Fig. 5.—Lingulectomy. *a*, Identification and mobilization of the lingular bronchus; *b*, traction dissection of the lingular pulmonary segment; *c*, approximation of pleural edges with interrupted sutures.

At the completion of the procedure the anesthetist again inflates the remaining pulmonary tissue, and further interrupted sutures may be placed to control undue leakage of air, should such be present. Generally, 5 Gm. of sulfanilamide are instilled into the thoracic cavity after thorough washing with saline solution and 1:10,000 aqueous solution of zephiran chloride. Closed suction drainage is carried out through a 28 French intercostal mushroom catheter for a period of forty-eight to seventy-two hours, or until no air is present in the pleural cavity. Bronchoscopic examination of the bronchi and stump with aspiration of any retained mucus or pus is carried out in the operating room immediately after operation. The patient is placed in an oxygen tent for from twelve to thirty-six hours. From 120,000 to 240,000 units daily of penicillin, given by the intramuscular route postoperatively, has been shown conclusively by White and his associates[29] to reduce drastically the incidence of empyema after surgical procedures for suppurative pulmonary disease. General supportive measures, as well as early mobilization of the patient, complete the regimen. Intravenous administration of fluids should be utilized cautiously. Occasionally a trained physical therapist can aid in rehabilitating patients after thoracic operations by instruction and exercises for improvement of ventilation and posture.

ANALYSIS OF CLINICAL DATA

During the past two years, seventeen patients who had bronchiectasis have been treated surgically by this technique of lingulectomy. There were four men and thirteen women patients, whose ages ranged from 6 to 43 years (average 20.6 years). The majority had as their chief symptom a chronic cough, productive of foul purulent sputum, which had begun between the first and the fifth year of age. In many cases, an initial episode of measles, whooping cough, pneumonia, otitis media, or other disease could be elicited. Subsequent typical symptoms were fever and hemoptysis. The frequently associated pansinusitis has been the subject of much controversy as to etiologic relationship.

Medical measures were given a fair trial in a majority of cases and careful selection of cases for surgical treatment was made only after consideration of the age of the patient and the extent of the disease. In this group of cases the disease entity and the site of involvement were established by bronchoscopy and iodized oil visualization of the bronchial tree. At operation, the pathologist made a diagnosis of bronchiectasis with chronic pneumonitis in all cases, with associated adenoma in one case and a small region of partially healed tuberculosis in another case.

There have been no cases of simple lingulectomy without lobectomy, or bilateral lower lobectomy with lingulectomy, although one potential case of each has been under observation. Recently, the latter patient has undergone preliminary right lower lobectomy for bronchiectasis.

The vital role that penicillin has played in decreasing postoperative complications and length of stay in the hospital is demonstrated by an average stay of forty-one days with empyema in two of three cases before the use of

penicillin, while since penicillin has been employed the average stay has been 18.3 days with no empyema developing.

We feel, as did Maier,[30] that the primary aims of preoperative care are (1) to decrease bronchial and parenchymal inflammation, (2) to decrease bronchial secretions, (3) to decrease virulence and numbers of existing bacteria, and (4) to improve the patient's general condition. Postoperatively, one should (1) avoid retention of bronchial secretions, (2) avoid anoxia, (3) prevent intrapleural infection, and (4) aid in the early expansion of the residual pulmonary tissue.

It is felt that this technique will further (1) the reduction of postoperative morbidity and mortality rates in cases of pulmonary resection, (2) the increase in number of surgical cures of bronchiectasis by offering relatively atraumatic lingulectomy, and (3) the increased feasibility of bilateral lobectomy by minimizing the amount of normal pulmonary tissue removed.

COMPLICATIONS

1. Postoperative atelectasis of the left upper lobe developed in eight cases (47 per cent), requiring from one to four bronchoscopic aspirations. The increased morbidity from this cause attending lingulectomy is evident, since Maier[30] has estimated only a 10 per cent incidence of atelectasis following simple lobectomy. This complication has been observed by Churchill and Belsey[6] to follow lingulectomy more frequently than it follows simple lobectomy. It has been stated by Chesterman[31] and by Maier[30] that postoperative collapse of the lung is the most important single factor in morbidity. The postoperative edema attending the division of the lingular bronchus was the most frequent cause, although granulation tissue in one case and inflammatory bronchostenosis of the bronchus of the left upper lobe in another case was the factor underlying the atelectasis. In later cases, the lingular stump was made longer to avoid this encroachment on the stem bronchus. Its position permits good drainage so that pooling of secretions will not occur. In none of these cases has bronchoscopic aspiration of retained secretions in the left upper lobe been required, although in one case there was atelectasis in the right lower lobe.

It was found wise to incorporate an iodide expectorant mixture in the routine postoperatively about the second day, as this facilitated raising of sputum by thinning secretions. The steam kettle was similarly of value in some cases.

2. Pleural effusion, an inevitable sequel of thoracotomy, is generally removed adequately by continuous closed drainage under slight suction (15 cm. of water) through a 28 French catheter. The catheter is removed after from three to four days. Thereafter, the effusion may be drained by aspiration through a needle. Excessive quantities of such fluid should be removed to avoid a deleterious thickening of the pleura, but one should keep in mind that empyema may be the result of injudicious aspirations.

3. Empyema was frankly present in one case and was suspected in one other case. In both cases only sulfadiazine had been administered preoperatively and postoperatively.

4. Bronchopleural fistula was present in the one case in which empyema had developed.

5. Wound infection of minor grade was present in one case. Nevertheless, the patient was hospitalized for only twenty-three days.

6. Anemia was treated at operation and postoperatively by infusion of from 500 to 2,500 c.c. of citrated whole blood. Iron preparations and vitamins were included in the regimen in all cases.

SUMMARY

Great advances in thoracic surgery in the past two decades have reduced the mortality rate in lobectomy for suppurative pulmonary disease to below 5 per cent. Because of the prevalence and seriousness of bronchiectasis, early diagnosis is of particular importance in augmenting the number of cases in which surgical treatment is applicable. Emphasis should be laid on the role played by the lingular division of the left upper lobe in bronchiectasis.

A surgical technique for segmental pulmonary resection with particular applicability to the lingula has been described. By using the divided lingular bronchus for traction dissection, the diseased bronchus, its subdivisions, and adjacent parenchyma may be simply and completely removed. Early reexpansion of pulmonary tissue is facilitated by use of interrupted sutures and avoidance of clamps on normal pulmonary tissue. A review of seventeen cases in which this technique was used is presented, and the complications of pulmonary resection are discussed.

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PNEUMOTHORAX THERAPY FOR EARLY BRONCHIECTASIS

With Report of Cases

Herman Hennell, M.D.
New York, N. Y.

THE recent advances in the surgical treatment of thoracic diseases have resulted in progressively lower operative mortality. As a result, lobectomy for bronchiectasis has been receiving first consideration in the management of this disease. Under these circumstances one hesitates to advocate less radical measures, especially since medical treatment for bronchiectasis has generally proved a failure in the past. Nevertheless, pneumothorax therapy for early bronchiectasis has produced such gratifying results in a group of six cases under my care that I feel prompted to report the results of this method of treatment and discuss its rationale. This procedure if judiciously employed has no mortality, no morbidity, and no serious complications. Furthermore, the use of pneumothorax does not preclude the subsequent employment of radical surgical therapy if the pneumothorax is promptly relinquished when success is not achieved in a reasonably short time.

THE RATIONALE OF PNEUMOTHORAX THERAPY FOR BRONCHIECTASIS

The rationale of pneumothorax therapy for bronchiectasis is based on certain concepts of the pathogenesis, physiology, and dynamic mechanism of the disease.

The primary factor in the pathogenesis of bronchiectasis is the weakening of the bronchial wall which results from injury of its muscular and elastic tissues by infection. Normally the bronchi dilate during inspiration and return to their normal caliber during expiration. The physiologic bronchial dilatation during inspiration and the elastic recoil during expiration are modified in the presence of injury to the bronchial wall, namely, the bronchi dilate more and retract less, with resultant bronchiectasis. Once the injury to the bronchial wall has taken place this tendency to bronchial dilatation will manifest itself even during ordinary respiration. It will be greatly aggravated by a number of other factors which operate as a result of bronchopulmonary disease of which bronchiectasis is the sequel. These factors are (1) prolonged cough, (2) shrinkage of the pulmonary parenchyma in the form of pulmonary atelectasis or fibrosis, and (3) persisting or recurring infection with stagnation of purulent secretions.

The excessive tension upon the bronchial walls during coughing, especially during the deep inspiratory phase which initiates the cough mechanism, serves to augment the process of dilatation. When, in addition, there is present an obstruction in the larger bronchi caused by a neoplasm, a foreign body, retained

From the Group for Thoracic Diseases and the Medical Services, the Mount Sinai Hospital.
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secretions, or an inflammatory stricture, the air is trapped in the lung and bronchi during the expiratory phase, and, because of the resultant high positive pressure, bronchial dilatation is further favored. The parenchymal changes in the lung which predispose to the development of bronchiectasis are either pulmonary atelectasis or pulmonary fibrosis. Under these conditions, the pull on the injured bronchi exerted during inspiration by the expanding thorax will be transmitted through a relatively rigid lung, instead of the usual elastic normal pulmonary parenchyma; this greater and more direct pull favors bronchial dilatation. Furthermore, the decreased volume of an atelectatic or fibrotic lobe results in a greater than normal difference between the endobronchial pressure (which approaches atmospheric) and the lowered intrapleural pressure (which is more negative than exists normally in the presence of atelectasis or fibrosis), further augmenting the tendency to dilatation of the injured bronchi.

Another factor favoring the development of bronchiectasis is the stagnation of the secretions. This tends to maintain a chronic infection of the bronchi and the contiguous parenchyma, thereby assuring the persistence and progression of the bronchiectasis.

An appreciation of the foregoing factors in the pathogenesis and mechanism of bronchiectasis suggests the following objectives in the treatment of this condition: (1) to diminish the trauma of respiration by decreasing its force or by eliminating it entirely in the diseased portion of the lung; (2) to decrease or eliminate the trauma of cough; (3) to counteract the increased pull on the diseased bronchi because of a lowered intrapleural pressure incidental to atelectasis or fibrosis of the pulmonary parenchyma; (4) to eliminate the infection in the lung and bronchi. That pneumothorax can accomplish these objectives will be illustrated by the case reports. In all the cases here reported as well as in a small group of chronic cases reported elsewhere,[8] in which the patients were successfully treated by the induction of a low-tension pneumothorax, there was a selective collapse of the involved portion of the lung; the highly negative intrapleural pressure was brought to an approximately normal level; the cough promptly decreased and then disappeared within one to four weeks; and infection subsided promptly and permanently, judging by long-term results.

A number of authors[1-5] have expressed views similar to the foregoing regarding the pathogenesis of bronchiectasis. Anspach[1] and Warner[4] have particularly stressed the importance of atelectasis as a dynamic factor in the production of bronchial dilatation. On the other hand, Tannenberg and Pinner[6] hold a contrary view on this subject. The latter authors found in their experiments on rabbits that atelectasis, and especially the factor of increased negative intrapleural pressure, played no role in the pathogenesis of this disease. However, my own concepts seem to be well supported by clinical experience as illustrated by the case reports which follow.

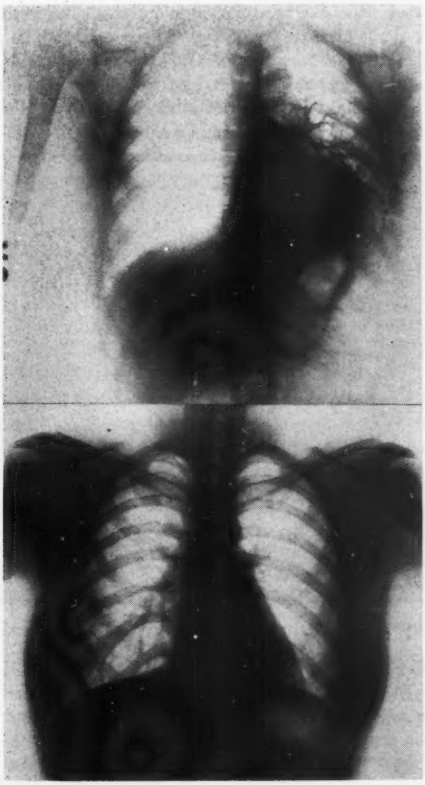
CASE REPORTS

CASE 1 (No. 387541).—C. E., a young girl 14½ years old, was admitted to the Mount Sinai Hospital on Dec. 6, 1935, in the fourth week of illness which was characterized by temperature up to 103° F., cough, purulent expectoration, and pain in the lower left side of the chest.

Examination on admission showed signs of bronchopneumonia in the left lower lobe. This was confirmed by a roentgenogram.

During the first ten days in the hospital the temperature subsided to a lower level, but the cough persisted and became more productive of purulent sputum. The physical signs as well as the roentgenograms made ten days after admission showed the development of atelectasis in the involved part of the left lower lobe (Fig. 1, *A*). The heart became displaced moderately to the left, and the roentgen shadow showed increased density. In the lateral view the atelectatic bronchopneumonia was seen to be confined to the anterolateral and posterolateral segments of the lobe. Furthermore, the bronchi in this region could be identified by the air within them and were seen to be considerably dilated.

A.



B.

Fig. 1.—*A*, Roentgenogram of the lungs showing an atelectatic bronchopneumonia in the left lower lobe with moderate displacement of the mediastinal structures to the left. The bronchi in the left lower lobe are visualized with the aid of iodized oil and show crowding and marked tubular bronchiectasis.

B, Roentgenogram made three years later showing an almost normal appearance of the expanded lung.

Although the patient's fever subsided in the fourth week of hospital stay, the cough persisted and the expectoration became more profuse and continued to be frankly purulent despite postural drainage. Bronchoscopy revealed large amounts of purulent secretion in the anterolateral branches of the left lower lobe recurring after suction. There was no evidence of bronchial obstruction. These bronchi appeared considerably dilated and this

was confirmed by bronchography (Fig. 1, *A*). Because of the progressive increase in the cough and purulent expectoration at the end of eight weeks of illness with atelectatic suppurative bronchopneumonia complicated by bronchiectasis, despite bronchoscopic and postural drainage, it was felt that active therapy was indicated. Lobectomy appeared too drastic a procedure for so relatively mild and early a lesion. It was therefore decided to try pneumothorax therapy in the hope that it might accomplish a clinical cure.

Pneumothorax therapy was instituted on Jan. 3, 1936. A free pleural space was found and 500 c.c. of air were allowed to enter the pleural cavity. It was noted that the intrapleural pressure was considerably more negative than existed normally (-18 and -8 cm. of water on inspiration and expiration, respectively), a finding which was anticipated in view of the presence of atelectasis. A selective pneumothorax was promptly established. The atelectatic left lower lobe was allowed to retract and was put at rest after the third refill of 500 c.c. of air one week after the treatment was started. The patient was then discharged from the hospital to be observed further and to receive weekly refills in the chest clinic of the outpatient department.

The effect of pneumothorax was prompt and striking. After a transient increase in the amount of sputum, the cough and expectoration showed marked and progressive decrease after the second day, and they practically disappeared by the time the patient was discharged from the hospital eight days after instituting pneumothorax therapy.

The patient received pneumothorax refills at weekly and later at biweekly intervals for about two years. The pneumothorax therapy was continued for a longer period of time and maintained a greater degree of collapse of the uninvolved portions of the left lung than was the practice in subsequent cases. The patient continued to do well and it was feared that discontinuing the treatment too soon would jeopardize the progress. As will be seen in the reports on the subsequent cases a more limited course of pneumothorax, confined to a period of six months, has proved equally efficacious in the treatment of early cases.

This patient has remained under observation since 1935. When last seen in June, 1944, she had remained entirely well. She had had many "colds" during these nine years, some of considerable severity, but none of them had resulted in a chronic cough, indicating that, while the anatomic defect in the bronchi probably persisted, a clinical cure was achieved and maintained. The roentgenogram of the expanded lung presented an almost normal appearance (Fig. 1, *B*), showing apparent resolution of the pneumonic process in the left lower lobe.

Comment.—A spontaneous cure was not likely to occur in this case in view of the apparent persistence and progression of the lesion after eight weeks of illness despite postural and bronchoscopic drainage. The dramatic improvement which followed the institution of pneumothorax therapy in this and similar cases was so striking and definite that it could not be regarded as an accident.

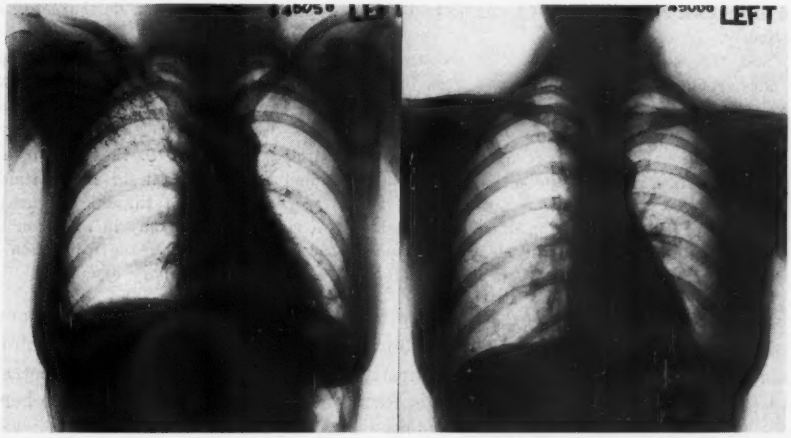
CASE 2 (No. 509584).—R. S., a widow 35 years old, was admitted to the Mount Sinai Hospital on Aug. 19, 1943. She was known to have essential hypertension for many years, but past pulmonary history was otherwise negative. The patient stated that she was in apparently normal health until about four and one-half months before admission to the Hospital.

The present illness began with signs and symptoms of a severe grippe, including cough, expectoration of purulent sputum, and temperature up to 102° F. daily. As these symptoms failed to subside after one week's treatment at home the patient was hospitalized in another institution. While in that hospital she received a course of sulfonamide therapy without any effect. At the end of the fourth week of hospitalization the fever, cough, and expectoration persisted. The expectoration increased to 4 ounces in twenty-four hours and was purulent in character. According to the report subsequently received from that hospital the patient's sputum showed the presence of acid-fast organisms on one occasion, and the physical and roentgen-ray findings in the lungs seemed consistent with a diagnosis of nodular and exudative pulmonary tuberculosis involving the right upper lobe. The occurrence of moderate

hemoptysis on two occasions was considered as additional evidence of active pulmonary tuberculosis.

Pneumothorax therapy was, therefore, instituted and a good collapse of the right upper lobe was produced and maintained by refills of air for a period of two months. In addition, the patient underwent a rest cure in the country. Under this regimen the fever subsided, the patient's general condition improved, and she gained five pounds in weight. However, the expectoration showed little change, and despite the presence of 4 ounces of sputum daily, repeated search for tubercle bacilli yielded negative results. The pneumothorax was, therefore, discontinued and postural drainage was instituted but without any effect on the patient's symptoms. She was referred to the Mount Sinai Hospital four and one-half months after the onset of the illness, with cough and profuse expectoration as the chief complaint.

The significant findings on admission included the following: There were fine and medium moist râles in the right upper lobe, especially after coughing, but no other abnormal physical signs and no roentgen evidence of pulmonary tuberculosis. At the base of the left lung there was moderate dullness, bronchial breathing, increased whisper and voice, and medium moist râles. The roentgenogram showed a triangular density within the cardiac shadow, and the heart was displaced moderately to the left indicating atelectasis or fibrosis of the left lower lobe (Fig. 2, *A*).



A. *B.*

Fig. 2.—*A*, Roentgenogram of the lungs showing a triangular density within the cardiac shadow indicating a shrunken left lower lobe. The bronchi of this lobe are outlined by iodized oil and show a marked degree of bronchiectasis. The right upper lobe and its branches appear normal.

B, Roentgenogram made nine months later showing an almost normal appearance of the expanded lung.

Bronchoscopy revealed the presence of large quantities of pus of a peculiar sweetish odor in all branches of the left lower lobe, recurring after suction. A small amount of purulent material was aspirated from the anterior and axillary division of the right upper lobe bronchi, but this did not recur after suction. The material was negative for tubercle bacilli on smear, and the culture yielded streptococcic hemolytic bacillus and *Streptococcus viridans*.

There was considerable hypertension, the blood pressure readings ranging from 165 to 218 systolic, and from 115 to 135 diastolic. The heart showed little or no enlargement and the kidney function appeared normal on all tests. The eye grounds showed early changes of hypertensive retinopathy, including generalized arteriolar narrowing and localized areas of spasm. There was no papilledema or retinal exudate.

There was a moderate leucocytosis but no other significant abnormality in the blood. The sedimentation rate was normal. The general condition of the patient was good. There were occasional rises of rectal temperature to 100.2° F.

Based on these findings the clinical diagnosis was as follows: (1) pneumonitis with atelectasis or fibrosis of the left lower lobe associated with extensive suppurative bronchiectasis; (2) bronchitis and possibly early tubular bronchiectasis in the right upper lobe; (3) essential hypertension.

Bronchographic examination with the aid of iodized oil (Fig. 2*A*) confirmed the diagnosis of extensive bronchiectasis in the left lower lobe. Surprisingly enough, the bronchi in the right upper lobe presented a normal appearance.

Pneumothorax therapy was instituted on the left side on Sept. 2, 1943. A free pleural space was found with ease, and 500 c.c. of air were allowed to flow in. The initial pleural pressure was much more negative than exists normally in the pleural cavity. Another refill of 500 c.c. was given the next day and repeated five days later. By this time an optimum pneumothorax was apparently established; the left lower lobe was put at rest and showed no change in volume during inspiration and expiration; the mediastinal structures were returned to their normal position; and the uninvolved left upper lobe was only partially collapsed. From that time on refills were made at weekly intervals for a period of six months. The amount of each refill was determined by the fluoroscopic status of the left lung before and after each refill, the object being to maintain an optimal pneumothorax as characterized previously.

At the end of the first week of treatment the cough and expectoration were decreased by one-half; at the end of the second week these symptoms disappeared entirely. During the succeeding five and one-half months the patient remained free from cough and expectoration and the pneumothorax was discontinued.

The patient's pulmonary condition remained entirely satisfactory to the time of this report. On May 31, 1944, she was admitted to the Mount Sinai Hospital for the treatment of hypertension which had shown a tendency to get worse. She went through two major operations for the hypertension during a period of two months without any ill effect on the pulmonary condition. At the time of this report, seveneen months after the institution of pneumothorax therapy, the patient had remained free from all pulmonary symptoms.

Comment.—This case presents a number of interesting features which merit special comment. First, it illustrates how rapidly advanced saccular bronchiectasis can develop as a sequel of suppurative bronchopneumonia with atelectasis, and how promptly and effectively this form of early bronchiectasis can be benefited by pneumothorax therapy.

It is also of interest that what was apparently a suppurative bronchopneumonia in the right upper lobe was so readily mistaken for tuberculosis. The physical signs and roentgen appearance are indistinguishable in the two conditions. Hemoptysis is another feature which these two conditions may have in common. That acid-fast bacilli may be found in pulmonary lesions not caused by the tubercle bacillus is less generally known. In a recent study of the subject[7] it was shown that acid-fast bacilli are frequently found in nontuberculous conditions, and when the other findings in a case strongly suggest a nontuberculous etiology the true nature of these acid-fast organisms must be determined by cultural characteristics and animal inoculation before a diagnosis of tuberculosis can be established.

The possible favorable effect of the pneumothorax treatment on the process in the right upper lobe is worthy of speculation. Under its influence the exudative lesions in that lobe resolved, and bronchographic examination four

months later showed no evidence of bronchiectasis of that region. It is quite true that this could have occurred spontaneously. However, our experience in another similar case inclines us to regard pneumothorax therapy as an effective measure in preventing the development of bronchiectasis in the course of protracted suppurative bronchopneumonia. The case referred to is that of a man 30 years old (S. S. No. 405320) with severe suppurative bronchopneumonia in the right upper lobe, with marked destruction of the pulmonary parenchyma and resultant cavity formation at the end of three months of illness. His clinical course was also characterized by repeated hemoptysis. Pneumothorax therapy was instituted principally in an attempt to control the hemoptysis. The response to treatment was prompt and definitive. The fever subsided and all pulmonary symptoms disappeared soon after the treatment was started. Under pneumothorax therapy the process in the right upper lobe resolved completely and the patient remained well to the present time.

Another feature of this case which merits mention is the fact that the patient's pulmonary condition remained inactive after two major operations for hypertension which required long periods of anesthesia.

CASE 3 (No. 499320).—J. B., a young man 16 years old, was admitted to the Mount Sinai Hospital on Dec. 8, 1942, in the fifth week of an illness which was characterized by temperature up to 102° F., by cough productive of large amounts of purulent sputum, and by pain in the right side of the chest aggravated by breathing and coughing. The preadmission diagnosis was primary atypical pneumonia. Two full courses of sulfonamide therapy had no influence on the disease.

On admission the patient appeared acutely ill. The signs in his chest were those of pneumonia in the right lower lobe associated with pleurisy. This was confirmed by a roentgenogram which showed a bronchopneumonia with partial atelectasis in the right lower lobe and slight displacement of the mediastinum to the involved side. In addition there was evidence of a small pleural exudate in the axillary portion of the right lung.

The purulent sputum showed no pneumococci and no tubercle bacilli, but beta hemolytic streptococci were recovered on culture. Pleural aspiration yielded about 50 c.c. of clear straw-colored fluid showing a moderate number of lymphocytes, but no organisms on either smear or culture.

Although the patient's temperature subsided to normal levels on the tenth hospital day, the cough remained severe and the sputum continued to be moderaely profuse and purulent. Physical and roentgen-ray examination at this time showed persistence of the pneumonic process in the right lower lobe. Furthermore, the involved lobe appeared more atelectatic than before as shown by increased displacement of the mediastinal structures to the right (Fig. 3, *A* and *B*).

Bronchoscopy showed the bronchi of the right lower lobe to be filled with creamy nonodorous pus which occurred after suction. Immediately after bronchoscopic drainage, moderate re-expansion of the right lower lobe took place as was evidenced by the appearance of breath sounds over that part of the lung. This was also confirmed by fluoroscopic observation. However, this improvement was only temporary.

Bronchoscopy was repeated four times during the succeeding three weeks, and expectoration was encouraged by postural drainage, generous administration of iodides, and inhalation of steam and of 5 per cent CO_2 in oxygen at one- to two-hour intervals. Transitory re-expansion of the lung occurred on several occasions but recollapse followed each time after a few hours.

In the roentgenogram made in the tenth week of the patient's illness the bronchi in the atelectatic left lower lobe were outlined by the air within them and showed tubular bronchiectasis (Fig. 3, *A* and *B*). Because of the persistence of the symptoms and the evi-

dence of early bronchiectasis in the right lower lobe ten weeks after the onset of the illness, it was decided to institute pneumothorax therapy.

A free pleural space was easily found and the initial pressures were –16 and –6 cm. water on inspiration and expiration, respectively. As in the other cases, after four refills of 400 c.c.

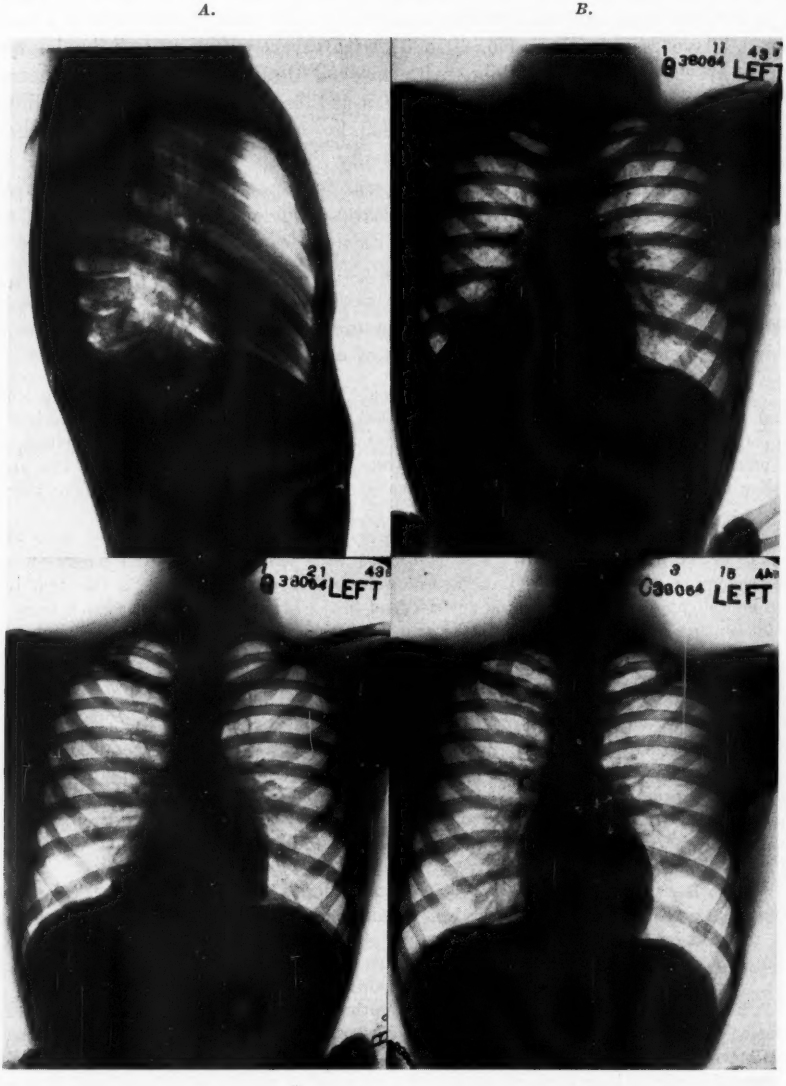


Fig. 3.—*A* and *B*, Roentgenograms of the lungs showing an atelectatic pneumonia in the right lower lobe. The heart is slightly displaced to the right. Note the tubular dilatation of the bronchi in the involved lobe as outlined by the air within them.

C, Roentgenogram showing selective collapse of the diseased right lower lobe by a low tension pneumothorax.

D, Roentgenogram made fourteen months later showing an apparently normal appearance of the lungs.

of air, the involved right lower lobe was selectively collapsed and put at rest by the low tension pneumothorax (Fig. 3, *C*). The cough and expectoration diminished after three days of pneumothorax and ceased at the end of one week. Before the end of the second week the boy was well enough to be discharged to the outpatient department. Weekly refills of 400 to 500 c.c. of air were continued for a period of six months during which time he remained symptom-free and gained a good deal of weight. Two months later the lung was fully re-expanded and he had no difficulty in enlisting in the Coast Guard service.

Roentgen-ray examination ten months later (Fig. 3, *D*) showed an apparently normal appearance of the lungs. When last seen in November, 1944, he appeared in excellent health and reported that he felt able to perform the arduous duties in the United States Navy.

Comment.—This is another case of suppurative bronchopneumonia with atelectasis and early development of bronchiectasis in the involved portion of the lung. As in all the other cases, pneumothorax therapy was resorted to only after all other measures failed during a trial period of at least two months.

The measures included postural drainage, repeated bronchoscopic aspirations, generous use of expectorants, frequent inhalations of 5 per cent CO_2 in oxygen, inhalations of steam, as well as chemotherapy. These are valuable procedures in the treatment of persistent suppurative bronchopneumonia with a tendency to bronchial obstruction by thick exudate. In many cases these measures may prove adequate to clear up the process. Pneumothorax therapy is employed only after these measures fail and when it becomes apparent that the disease is progressing to the chronic stage with bronchiectasis.

The ease with which an optimal pneumothorax was established and maintained (despite the recent pleurisy), the prompt improvement, the consistently favorable course, the normal appearance of the lungs after re-expansion, and the ability of the patient to carry on the strenuous life of the Coast Guard service eight months after the treatment was begun and two months after it was discontinued are all worthy of note.

CASE 4 (No. 517438).—A. L., a schoolboy 15 years old, was admitted to the Mount Sinai Hospital on Mar. 6, 1944, with a history of frequent "colds" for many years. The most recent upper respiratory infection had occurred four months before admission and was followed by a severe cough productive of thick mucopurulent sputum. Three months before admission there occurred a febrile episode, with temperature rises up to 104° F., lasting five days, and followed by fatigability and a loss of eight pounds in weight. The cough, in the meantime, had improved considerably. Three weeks before admission dark urine was noted. No edema was observed. The patient was admitted to the hospital with a diagnosis of acute nephritis.

Examination on admission revealed the following significant findings: There were impaired resonance, diminished breathing, and numerous moist râles over the right lower lobe. The roentgenogram showed an atelectatic bronchopneumonia in this lobe. Within the infiltrated area there were noted streaks of increased aeration suggesting bronchiectasis. A roentgenogram made a short time later showed an increase in the extent of the infiltrations, and the areas of increased aeration were characteristic of cylindrical bronchiectasis (Fig. 4, *A*). There was considerable postnasal mucoid drip. Roentgenographic examination of the sinuses showed clouding of the right ethmoid, antrum, and sphenoid sinuses. The blood pressure on admission was 148/88. The heart was not enlarged. There was a moderate anemia and leucocytosis; the hemoglobin was 63 per cent, the red cell count 3,700,000, and the white cell count 13,600 with a normal differential.

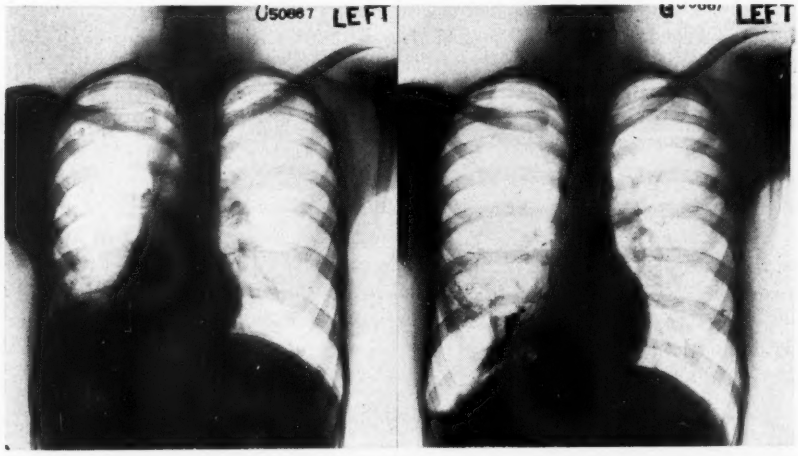
Urinalysis showed albumin 2 plus, moderate microscopic hematuria, concentration of 1010/1020. The blood chemistry findings were normal.

The patient's cough and expectoration were so moderate at the time of admission that he failed to mention them among the complaints. Their presence was elicited on direct questioning when the signs of bronchopneumonia in the right lower lobe were found on physical examination. However, on postural drainage a severe coughing spell was induced and substantial amounts of pure pus could be obtained on each occasion.

In order to confirm the diagnosis of bronchiectasis which was suggested by these clinical and roentgen-ray findings, bronchographic examination was done and it revealed extensive tubular dilatation of the bronchi in a shrunken right lower lobe (Fig. 4, *B*).

The treatment of the patient during the first three weeks of hospital stay consisted of bed rest, generous diet, sinus irrigation, and postural drainage. Under this regimen his general condition, the urinary findings, and the sinus infection showed improvement. However, the bronchopulmonary condition apparently progressed despite bed rest and postural drainage.

Since previous experience with pneumothorax therapy for early bronchiectasis was encouraging, it was decided to try it in this case.



A. *B.*

Fig. 4.—*A*, Roentgenogram of the lungs showing an atelectatic pneumonia in the right lower lobe. The dilated bronchi are outlined by the air within them.

B, Roentgenogram showing selective collapse of the involved right lower lobe by a low tension pneumothorax. The bronchi of the diseased lobe are outlined by iodozed oil and show marked bronchiectasis.

Pneumothorax treatment was begun on Mar. 25, 1944. The pleural space was easily entered and 400 c.c. of air allowed to flow in. The initial intrapleural pressure was -18 and -10 cm. of water on inspiraion and expiration, respectively (a pressure more negative than existed normally). Refills of 400 to 500 c.c. were given at intervals of two days. After the fourth refill on April 2, an optimal pneumothorax was established; the involved lower lobe was at complete rest, the uninvolved lobes were only partially relaxed, and the mediastinal structures were in normal central position.

During the first few days following the institution of pneumothorax therapy the expectoration increased. Shortly thereafter it began to decrease and three weeks later cough and expectoration, even on postural drainage, ceased entirely.

Concurrent with the marked and progressive improvement of the patient's pulmonary condition there was accelerated improvement of other symptoms: he began to gain weight rapidly, urine showed progressive clearing, hemoglobin rose from 63 to 85 per cent, and blood pressure declined to normal levels.

He was discharged from the hospital two weeks after pneumothorax therapy was started, at which time he was in very good condition and symptom-free. He continued to receive weekly refills at the chest clinic of the outpatient department, and he received final treatment on Oct. 4, 1944. Since then the lung has fully re-expanded. He was last seen on Jan. 17, 1945, having remained entirely well and able to carry on normally soon after discharge from the hospital.

Comment.—Perhaps a sufficiently long period of time has not elapsed as yet to warrant the conclusion that a clinical cure was achieved in the more recently treated patients. However, experience with two similar patients with extensive suppurative bronchiectasis which were successfully treated with pneumothorax early in the course of their disease warrants an optimistic attitude. Both these patients (No. 334838 and 322337) have remained well for periods of twelve and thirteen years, respectively, despite several episodes of severe respiratory tract infection which occurred since the pneumothorax was terminated. Furthermore, in a recent study[8] a small selected group of patients with chronic bronchiectasis of one to four years' duration was reported upon, in which the satisfactory clinical results produced by pneumothorax therapy have now lasted from seven to thirteen years.

Experience has convinced me that in those cases in which pneumothorax therapy ultimately produced a satisfactory clinical result the improvement was definite and prompt: within one to four weeks cough and expectoration ceased and fever, if present, subsided. This early improvement, once achieved, was progressive and the result lasting. This occurred in all the six early cases in which pneumothorax was used and also in the successful chronic cases. In the chronic cases delayed favorable results with pneumothorax therapy are not to be expected. In this group a short trial is sufficient to select the likely successes from the failures, and radical surgical measures can be employed promptly if the pneumothorax therapy proves ineffective.

Pneumothorax therapy for bronchiectasis has been tried many times but, as a rule, the results obtained have been so poor that this mode of treatment has fallen into disrepute. These poor results may be ascribed to the improper selection of cases and the continuance of the treatment in spite of an unsatisfactory early result. I found that satisfactory results with pneumothorax therapy for bronchiectasis followed only when a good and selective collapse of the diseased portion of the lung could be obtained promptly. This has, thus far, occurred in all six early cases but only in occasional chronic cases.

Admittedly, pneumothorax therapy does not relieve the patient of the dilated bronchi. However, as has been shown, it can control the infection in early bronchiectasis so that the patient may be restored to normal health. Furthermore, its effects in this regard appear to be permanent in the cases reported. This therapeutic procedure should, therefore, be given first consideration in cases of early bronchiectasis, and radical surgical measures should be employed only when pneumothorax fails to produce the desired results after a short trial.

With the advent of penicillin the value of this potent substance in suppurative bronchiectasis is being tested. Barach and associates[10] have been ob-

serving the effect of penicillin inhaled in a finely divided spray and Siltzbach[9] has been introducing the drug directly into the diseased area by a catheter. Whether either of these methods, or the intramuscular, or possibly the oral administration of massive doses of penicillin should supplant or be used in conjunction with the pneumothorax treatment here advocated will depend upon further experience.

SUMMARY AND CONCLUSIONS

1. A group of cases of early bronchiectasis is presented in which pneumothorax therapy was instituted after a two to four months' trial of the usual therapeutic measures (including sulfonamides, bronchoscopic aspirations, partial drainage, etc.) failed to arrest the progressive course of the disease.

2. The mechanism by which bronchiectasis develops is discussed.

3. Pneumothorax therapy produced a prompt and lasting clinical cure in all six cases in which it was tried. The mechanism by which pneumothorax produced this favorable result is discussed in detail.

4. The probable value of pneumothorax therapy in preventing the development of bronchiectasis in cases of protracted suppurative bronchopneumonia is discussed and illustrated.

5. Pneumothorax therapy should receive first consideration in cases of early bronchiectasis. Radical surgical measures should be employed in such cases only when pneumothorax fails to produce the desired results after a short trial.

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SOLITARY PRIMARY NEUROGENIC TUMOR OF THE LUNG

Report of a Case

J. P. Bartlett, M.D., and W. E. Adams, M.D.
Chicago, Ill.

PRIMARY neurogenic tumors of the lung are extremely rare, although neurogenic tumors are commonly found in the mediastinum. Kent and associates added 18 cases to a summary of 105 thoracic neurogenic tumors from available medical periodicals inclusive to 1944. None of these were located in the lung.[19] In a further search, especially of readily available English periodicals inclusive to November, 1945, no neurogenic tumors of the lung have been discovered. A letter from the Thoracic Tumor Registry, Washington, D. C., stated that there was no report of primary neurogenic tumor of the lung in the files.

Neurogenic tumors are often difficult to distinguish from fibrous tumors histologically. Intrathoracic fibrous tumors are relatively rare. Blades (1941) in a summary of the world literature could find only forty-one cases.[6] Few such tumors have been reported since then; none of these occurred in the lung.[8, 12, 16, 17, 23, 26] Numerous neurofibromas involving the lung, either primarily or by sarcomatous extension, are reported in patients afflicted with multiple congenital neurofibromatosis.[11, 21, 22, 30] Reports of primary sarcomas of the lung also seem to be uncommon in recent literature. References to forty-six cases are given.[3, 5, 9, 10, 13, 24, 25, 27, 29]

The present case of a solitary primary neurogenic tumor of the lung is being reported because of its rare occurrence and because of the problem presented in preoperative differential diagnosis of circumscribed hilar lesions. Only during the past twenty years have primary neoplasms of the thorax been observed, studied, and reported in any numbers. Lilienthal, in 1925, stated that primary neoplasms are among the rarer thoracic diseases, but are sufficiently numerous to come under the observation of most clinicians.[20] Adler (1912) in speaking of malignant tumors of the lung, which now rank third in incidence of all malignancies in men, said, "Is it worth while to write a monograph on the subject of primary malignant tumors of the lung?"

CASE REPORT

M. B. (No. 350057), a 45-year-old white housewife who was first seen in this clinic on Jan. 22, 1945, complained of the following: low back pain, on the right side over the sacroiliac region, present in the morning, worse on bending, but relieved by activity, of one year's duration; a lump in the region of the backache, discovered by her family doctor who stated the mass was pressing on a nerve and should be removed, first noted one month prior; sharp pains in the low thoracic and lumbar region of the back, of shooting character and

From the Department of Surgery of the University of Chicago.
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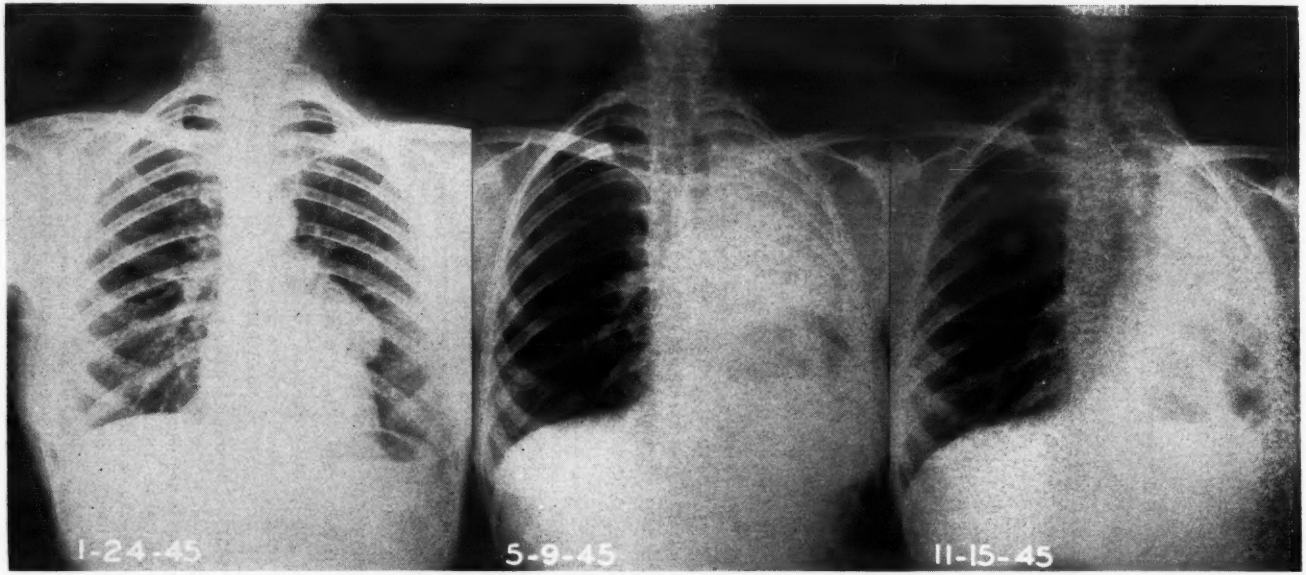
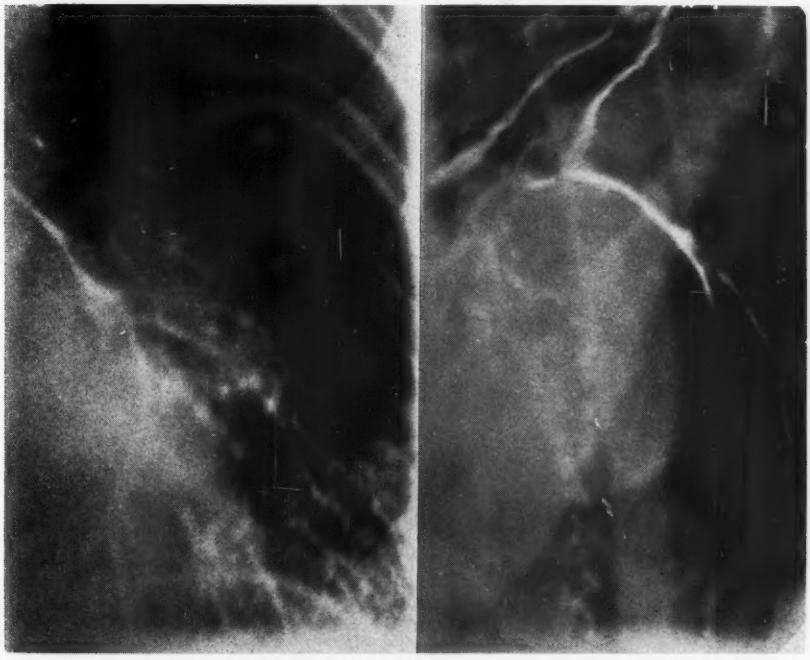


A. *B.* *C.*

Fig. 1.—*A*, Roentgenogram of chest showing circumscribed opacity projecting out from cardiac shadow. *B*, Roentgenogram of chest following left pneumonectomy showing fluid filling left pleural cavity, deviation of the trachea to the left, gas in stomach beneath, an elevated diaphragm. *C*, Roentgenogram eight and one-half months following pneumonectomy, demonstrating an elevated paralyzed diaphragm with gastric air bubble beneath. Note continued shrinkage of left side of chest cage and further shift of trachea to left.

radiating to the right lower quadrant anteriorly, noted only when not occupied with work, of two weeks' duration; easy fatigue, nervousness, and insomnia for about six months; thirteen pounds weight loss in past year; complaints referable to menopause, now under hormone therapy. The patient had no complaints referable to respiratory or cardiac system.

Physical examination revealed a well-developed and well-nourished patient who appeared to be in good health. The blood pressure was 135 systolic and 86 diastolic. Weight was normal for her age and height. The entire physical examination was normal except for a nodular, freely movable, nontender small mass over the right sacroiliac joint and a similar, partially fixed, 3 cm. mass over the left sacroiliac joint, but no other findings referable to neuromuscular or osseous system. Routine fluoroscopy revealed a pulsating, nonexpansile mass about 5 cm. in diameter, separate from the heart but adjacent to it in the left side of the chest. Blood and urine tests were entirely within normal limits. X-ray studies of the pelvis and spine showed only a minor congenital bony abnormality which also seemed to account for the soft



A. *B.*

Fig. 2.—*A*, Anteroposterior enlarged view of bronchogram showing circumscribed lesion below bifurcation of left main bronchus; relationship to heart and mediastinum is not clear. *B*, Bronchogram demonstrating lesion distal to main bronchus partly obstructing upper bronchus and, to less extent, the lower bronchial branches.

tissue masses, believed to be unimportant. Following a rational explanation that these findings were of no import, the patient's specific complaints improved rapidly. The nature of the asymptomatic mass in the left side of the chest proved to be a matter less easily settled. The first of a series of x-ray examinations showed a rounded mass extending to the left of the heart from the anterior mediastinum. It measured approximately 3 by 3 by 5 cm. in diameter and was located just below the bifurcation of the trachea. Fluoroscopy demonstrated clearly that the mass was not connected to the aorta. An iodochloral bronchogram demonstrated that the mass probably did not communicate with the bronchi, but displaced them and was distal to the

bifurcation of the main-stem bronchus, giving the impression of a dermoid cyst of the lower anterior mediastinum. Bronchoscopic examination was entirely negative (Figs. 1*A*, 2*A*, and 2*B*).

The surgical chest service at first considered the possibility of the tumor's being an aneurysm of the aorta, but practically ruled this out by fluoroscopic examination. Its position in the midanterior mediastinum protruding into the left side of the chest did not seem to put it into a category of smooth-walled neurogenic tumors which occur mainly in the posterior mediastinum but was more suggestive of a dermoid of the anterior mediastinum. The lack of calcification in the wall did not rule out a tuberculoma.[28] Malignant lymphoma had to be considered, but these lesions are usually less circumscribed and the margins are less sharp

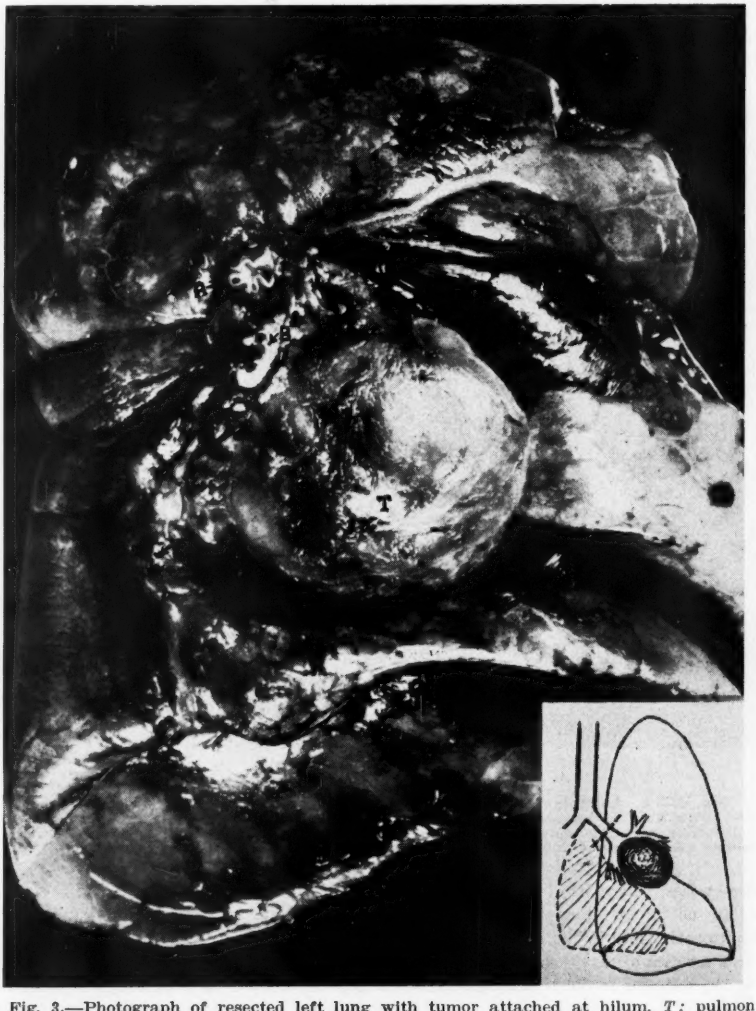


Fig. 3.—Photograph of resected left lung with tumor attached at hilum, *T;* pulmonary vein, *V;* main left bronchus, *B;* pulmonary artery, *A;* inserted diagram shows relative position of tumor to bifurcation of left main bronchus and heart, dotted line indicates level of resection.

and are lobulated. One might expect more symptoms if this were such a lesion. By size, location, and bronchoscopy, as well as lack of obstructive signs, a bronchiogenic carcinoma could not be ruled out.[4] On the basis of size, location, great possibility of malignancy, and the inability to make a definite diagnosis, exploratory thoracotomy was advised.[5]

Operative Procedure.—On Mar. 1, 1945, through a fourth left interspace incision, the pleural cavity was explored. A hard spherical tumor mass was found in front and distal to the left hilum, lying for the most part free in the pleural space between the upper and lower lobes of the left lung. After incision of the pleura overlying the tumor, the tumor was readily freed down to the division of the left main bronchus where it was found firmly attached distal to the bifurcation of the left primary bronchus. It was so intimately and firmly related to the bronchial wall that it was thought inadvisable to dissect the tumor free because of the danger of opening the bronchus or leaving tumor behind. Biopsy was thought to offer more possibility of complications than assurance, therefore, a left total pneumonectomy was performed in the usual manner. Following closure of the chest wall the residual air in the pleural cavity was removed and replaced with 550 c.c. of blood plasma containing 200,000 units of penicillin.

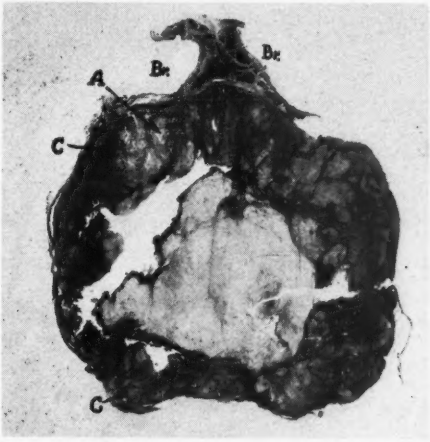


Fig. 4.—Natural size photograph of large microscopic slide made through tumor at bifurcation of left main bronchus, *Br;* showing areas of microphotographic reproduction of *A*, *B*, and *C*.

Convalescence following operation was uneventful, the patient being discharged from the hospital on the twentieth day. On Nov. 21, 1945, the patient returned to the clinic for a routine checkup, without specific respiratory complaints.

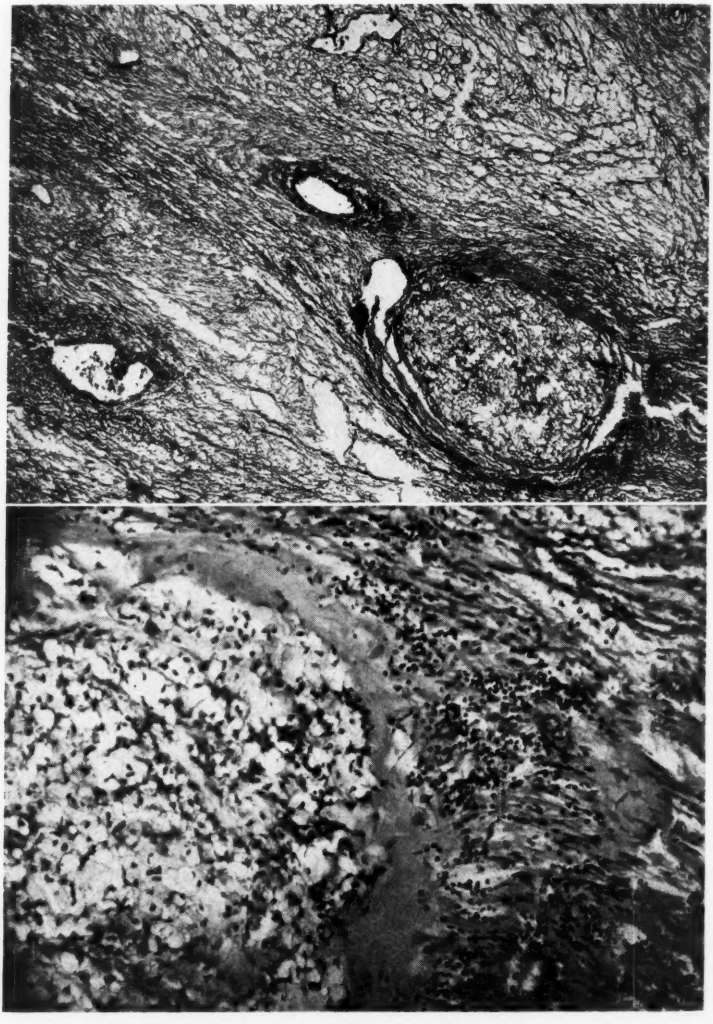
Pathologic Findings.—

Gross: With the left lung anterior surface upward, a smooth-surfaced, well-circumscribed, ovoid, firm tumor was seen attached anteriorly onto the left bronchus, distal to the main bifurcation. It measured 6½ cm. in diameter. Its superior surface was ruffed by the operative procedure of peeling it from the superior pulmonary vein. The tumor was fluctuant and seemed to contain a central mass. Its distal surface was covered by a thin layer of atelectatic lung tissue. The lung proper elsewhere, other than anthracotic pigments, was normal and inflated. The lymph nodes were anthracotic, but not enlarged, hard, or otherwise abnormal (see Fig. 3).

The tumor cut across through the bifurcation of the left main-stem bronchus was firmly fixed to the outer layers of the bronchial wall. It was not possible to separate the tumor from the bronchus without destroying tissues of both. Within the tumor was a large irregular space

partially surrounding a central mass. This space was filled with reddish-brown old-bloodlike substances. The central mass was a glary, light yellowish-brown color, and of soft consistency. The outer shell of tumor tissue was a light yellow-pink color and of a rubbery-firm consistency similar to that of peripheral fibromatous tumors. The bronchial mucosa showed no evidence of tumor extension, but the upper lobe bronchus was partially occluded by compression effect of the tumor (see Figs. 2, *B* and 3).

A.

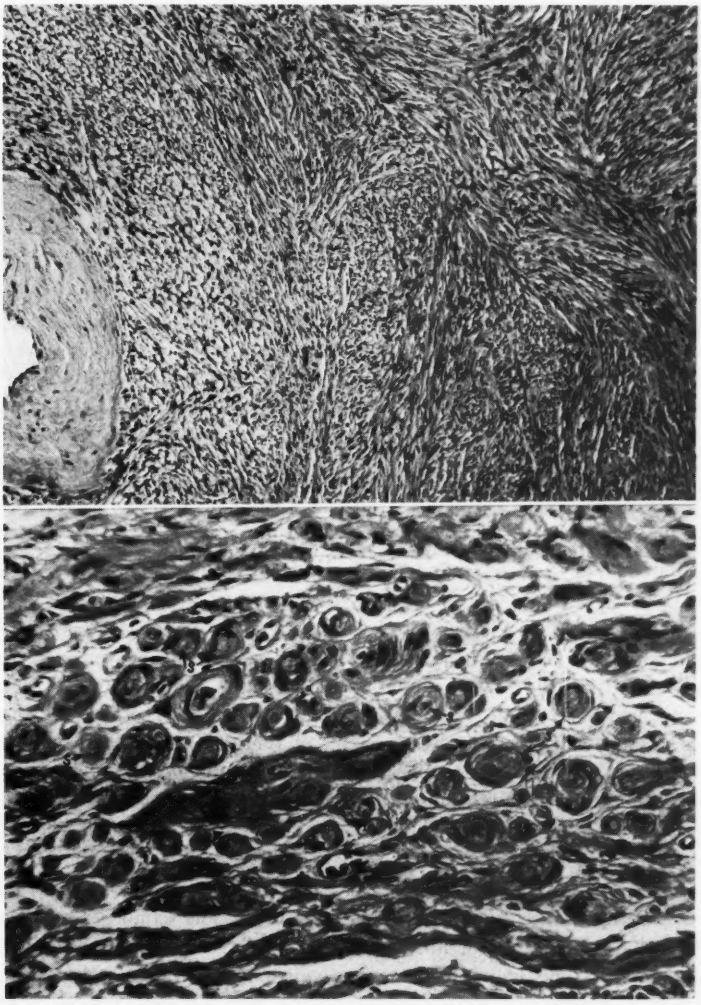


B.

Fig. 5.—*A*, Photomicrograph of area *A*, shown in Fig. 4, demonstrating loose and dense areas and vascular elements of tumor and a large hyalinized veinlike structure presumably plugged by tumorlike tissue (×80). *B*, Microscopic appearance of veinlike structure showing tumorlike tissue in lumen and dense tumor strands without (×225).

Microscopic Findings: The tumor was microscopically intimately attached to the bronchus and in some areas tumor tissue was separated from bronchial cartilage by a pseudocapsule of connective tissue 100 to 500 microns across. No actual invasion of the cartilage or mucosa was seen in the sections taken (Fig. 4).*

C.



D.

Fig. 5.—*C*, Photomicrograph from area *B*, shown in Fig. 4, illustrating dense tumor strands with definite tendency to palasading of nuclei, interspersed areas of freely vacuolated tumor cells, and a vessel with intimal proliferation (×135). *D*, Photomicrograph (area *c*) demonstrating Schwann cell proliferation of nerve fibriles in periphery of tumor, examples labeled *S* (×375).

*The large microscopic section was cut 10 to 14 mμ in thickness and prepared by means of a special technique by Henry Sallmen, special histological technician.

The outer tumor tissue had many mature venules and arterioles and capillary spaces throughout. In only one hyalinized veinlike structure was luminal occlusion seen, and in this case the loose cellular structure and collagenous strands could not be differentiated for certain from an organizing thrombus. Most arterioles of any size showed definite intimal and medial proliferation of their walls (Fig. 5, *A* and *B*).

The outer tumor tissue was composed of masses of swirling cells, varying from dense collagenous-like spindle cells, with elongated nuclei and showing a tendency to form parallel aggregates with alternate spaces of anuclear structure, to a very loose cellular structure of cells with clear or loose reticular vacuolations. Some of these cells resembled lipophages. Fat stains, with Sudan IV, showed little neutral lipoid substance in these cells and very little in other parts of the tumor. Mucicarmine stains contributed no positive information (see Fig. 5, *C*). On the margin of the tumor surface proximal to the bronchus, beneath lymphoid tissue containing anthracotic pigment granules, were areas of what appeared at first impression with hematoxylin and eosin stains to be sclerotic arterioles, similar to those structures seen in lesions of sclerosing angiomatous type. Further study with Van Gieson, Bodian, and Perdrau stained slides proved these areas to be concentric and circularly elongated nuclei of proliferated fibers of Schwann cells about nerve fibrils (Fig. 5, *D*). (The microscopic appearance of these areas was almost identical to those reported by Bailey in 1938.[4])

The central mass, partially separated from the outer tumor tissue by a space filled with what appeared to be fresh and old blood, was composed of acellular tissues resembling in structure the outer tumor tissue. The few remaining nuclei were pyknotic or partially broken up. The central portion showed uniformly poorly staining properties with all stains, and resembled tissues which have undergone coagulative necrosis.

DISCUSSION

From a clinical standpoint, circumscribed hilar lesions may be simulated by peripheral circumscribed tumors and are for the most part to be confused with metastatic tumors and infections which are in the minority in occurrence.[2,8] Alexander[1] stated that contrary to prevailing impression the majority of circumscribed intrathoracic neoplasms are intrapulmonary and malignant. Many of those tumors which are benign undergo malignant changes or cause disability of serious results by increase in size. Exploratory thoracotomy is indicated where no positive information is obtainable through the employment of modern diagnostic methods. Unless the patient is a poor surgical risk, x-ray therapy is to be used only when inoperable carcinoma or lymphoblastoma can be diagnosed.[2] Andrus stated, further, that operative determination of benignancy or malignancy cannot be made with accuracy, therefore, resection should be done when possible.[3]

Most authors agree that tumors of the nerves occur mainly in larger nerve trunks in nearly all parts of the body. They may be mainly fibrous as in the skin, or mainly neural as in the deeper regions. The tumors may be pure or mixed in character, single or multiple. Probably the majority of the ganglionic neuromas arise from the sympathetic nervous system. Grossly these tumors are usually slow growing, forming encapsulated firm or soft masses. Although sarcomatous neurofibromas or sarcomas often complicate multiple neurofibromatosis or undifferentiated tumors, it seems that it is rare for a primary benign neurogenic tumor to become sarcomatous.[14] The less differentiated tumors are true neuromas, neurinomas, fibroblastomas, Schwannomas, neurilemmomas, or lemmomas. Histologically, neurinomas are characterized by four features.

The main tissue is fasciculated with elongated cells or fibrous bands forming palisading units (type A, Ewing). The early stage in the formation of this tissue is thought to be the whorls of cells about the axis cylinder, believed by some authors (Bailey, Hermain, Penfield, Von Recklinghausen, and Robert Smith) to be a proliferation of perineural and epineural sheath fibrous tissues. Masson, in an elaborate study of regenerating nerve fibers and neuromas, traces, the formation of the palisades to the proliferation of nuclei and fibers in the cylinders of Schwann cells, and interprets the palisades as primative Meissner corpuscles. Embryologic studies show the Schwann cells to be derived from the primative neural crest. Ewing and Geschicter accept this view, while Herxheimer and Roth look upon the developmental process as occuring from both Schwann cells and fibrous perineurium and epineurium. The other main feature is a reticulated tissue (type B, Ewing) with few fibrous strands, irregularly scattered cells and much intercellular fluid lying in vacuoles or forming small cysts containing mucinous material. Some neuromas are quite vascular, suggesting a relationship to angiofibromas. It is also a characteristic feature for vessels within the tumor to have marked hyaline thickening of their walls, a proliferation of the intima and media.[14, 15, 31] Malignant changes are considered where myxomatous tissues or sarcomatous tissues are prominent, and especially if vascular invasion is seen. This case demonstrates the essential features of a neurinoma, including a small zone of Schwann cell proliferation. Of particular interest are the resemblances of this case to illustrations in cases reported by Kent and Bailey.

SUMMARY

1. What is believed to be the first case of solitary primary neurogenic tumor (neurinoma) of the lung, removed surgically, is reported.

2. The problem of preoperative differential diagnosis is discussed.

3. A detailed discussion of the pathologic findings and the basis of final diagnosis of a neurogenic tumor (neurinoma) of the lung is given.

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REPORT OF A CLINICAL TRIAL OF OXIDIZED GAUZE IN SEVEN THORACOPLASTIES

RICHARD A. S. CORY, M.B., CH.B., M.R.C.S., L.R.C.P.*
LIGUANEA, JAMAICA, BRITISH WEST INDIES

DURING the latter half of 1945, I was asked† whether I would be willing to try the use of oxidized gauze‡ sponges on some of my surgical patients.

It appeared that first stage thoracoplasty wounds would be ideal for studying the use and effect of any allegedly soluble material placed in wounds and left in after complete suture. These wounds are normally made in clean tissues and are reopened after three weeks for the purpose of carrying out the second stage of operation.

Under such circumstances, therefore, no better experimental material in human subjects could be found, as direct inspection of the interior of the wound and its contents after a period of a few weeks was undertaken.

It was decided, therefore, to use the oxidized gauze, one 4 by 4 inch square for each wound, to pack the commonest bleeding sites found in wounds of this nature. These sites are usually associated with the anterior portions of the rib periosteal sheaths and with the oozing spaces left after resection of the posterior rib ends and transverse processes of the vertebrae where persistent bleeding may occasion much trouble and loss of time.

The method decided upon was to cut one 4 by 4 inch oxidized gauze sponge into four pieces and to pack two of these into two anterior spaces and the other two into two posterior spaces.

The technique of thoracoplasty used calls for formalinization of rib periosteа, but as the oxidized gauze is sterilized in formalin, it would appear that no ill effect should follow from the use of formalin in the presence of the oxidized gauze, and in practice this was found to be true.

The wounds, however, are also subjected to a routine powdering with from 3 to 5 Gm. of sterile sulfathiazole powder before closure, and it was not certain what effect this might have upon the solubility of the oxidized gauze.

In a previous article,§ I established the fact that formalin and sulfathiazole used in the same wound have no harmful effect, nor do they appear by double decomposition or other chemical reaction to produce any substance which delays wound healing. It was consequently felt that the use of sulfathiazole and oxidized gauze together should be tried. Subsequent observation showed that this trial has been justified.

Oxidized gauze is soluble in slightly alkaline fluids, and with this in mind it was proposed to determine the pH of the serum in each wound three days, seven days, and fourteen days after operation.

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*Senior Medical Officer, King George V Jubilee Memorial Sanatorium.

†By Lieutenant Colonel D. Clark of the British Military Hospital, Jamaica, who had received these sponges from Colonel F. S. Gillespie of the Medical Field Service School, Carlisle, Pa., and very generously provided us with a few of them for trial.

‡Oxidized gauze is marketed by Parke, Davis & Co., Detroit, Mich., under the trade name of "Oxycel" and by Johnson & Johnson, New Brunswick, N. J., under the name of "Hemo-Pak"

§Cory, Richard A. S.: J. THORACIC SURG. 12: 653, 1943.

TABLE I. POSTOPERATIVE BLOOD AND WOUND STUDIES*

CASE	SULFATHIAZOLE ?	THREE-DAY STUDIES								SEVEN-DAY STUDIES								FOURTEEN-DAY STUDIES								REMARKS
		BLOOD				SERUM				BLOOD				SERUM				BLOOD				SERUM				
		HEMOGLOBIN (%)	TOTAL (WHITE)	POLYMORPHONUCLEARS (%)	LYMPHOCYTES (%)	TOTAL (WHITE)	POLYMORPHONUCLEARS (%)	LYMPHOCYTES (%)	pH	HEMOGLOBIN (%)	TOTAL (WHITE)	POLYMORPHONUCLEARS (%)	LYMPHOCYTES (%)	TOTAL (WHITE)	POLYMORPHONUCLEARS (%)	LYMPHOCYTES (%)	pH	HEMOGLOBIN (%)	TOTAL (WHITE)	POLYMORPHONUCLEARS (%)	LYMPHOCYTES (%)	TOTAL (WHITE)	POLYMORPHONUCLEARS (%)	LYMPHOCYTES (%)	pH	
1. O. F.	Yes	74	13,200	77	14	16(	100	–	Between 7 & 8	70	7,200	68	15	29,000	90	10	7.275	72	10,30(	44	24	1,496	34	62	7.375	Unusually little postoperative fever
2. S. C.	No	94	9,000	75	16	10,000	100	–	7.125	80	7,400	65	25	7,900	100	–	7.125	90	9,000	68	24	40,300	94	6	7.15	Low irregular temperature, 2 weeks
3. F. C.	Yes	70	10,500	82	12	16,000	98	2	6.95	70	8,500	75	20	14,273	98	2	7.0	68	8,000	80	11	–	–	–	6.5	Clear serum but inflammatory reaction in wound
4. A. A.	Yes	76	9,600	73	19	16,434	96	4	7.075	82	8,400	61	26	–	–	–	7.025	–	–	–	–	–	–	–	–	Postoperative spread of lung lesion
5. V. D.	Yes	90	17,200	80	11	–	–	–	7.075	84	13,750	74	20	8,525	98	2	6.9	80	10,800	69	20	2,560	18	82	7.0	Very little postoperative fever
6. R. F.	No	80	10,250	78	16	16,243	98	2	7.1	76	10,600	78	17	500	98	2	7.2	74	9,200	83	13	1,804	100	–	6.4	2 days' postoperative temperature
7. M. M.	Yes	82	6,300	53	38	1,365	99	1	7.5	–	–	–	–	1,100	100	–	6.2	82	6,500	58	36	1,000	92	8	6.7	5 days' fever; reached 103° F. once

*All the patients in this series were colored Americans.

Parallel with these determinations, total and differential blood cell counts were ordered, as well as total and differential cell counts on the wound serum at the same intervals of time. The results are shown in Table I.

The figures obtained are far too few, and also too varied, to be of either practical use or statistical value, but nevertheless they are included here as being of some interest, particularly with regard to the pH findings.

The final investigation of the material placed in the wound came on the day of reoperation, when careful note was made of the (a) apparent firmness of healing, (b) quantity of serum present, (c) appearance of the inside of the wound, and (d) quantity and appearance of the oxidized gauze remaining undissolved. These findings are here reproduced in tabulated form (Table II).

I am satisfied that the claims made in favor of oxidized gauze have been upheld by the results obtained in this small series of cases.

The material appears in no way to retard healing and, in some instances, seems to be responsible for a remarkable growth of new tissue between raw surfaces. In such cases, however, it probably acts indirectly by limiting the amount of blood lost into the wound from various bleeding points, thus reducing the quantity of wound serum which normally will tend to keep these raw areas separated until it has been either absorbed or aspirated.

This too quick adherence of the walls of a thoracoplasty wound is probably not desirable, as it will tend to reduce collapse of the lung by causing its premature attachment to the undersurface of the scapula. When a wound develops a collection of serum which is not excessive, this rapid attachment of periostea and intercostal muscles to subscapular tissue does not occur to any great extent between operative stages, and collapse of the lung is probably aided.

On application to raw surfaces, oxidized gauze sponges swell slightly and, within one or two minutes, become of the consistency of wet blotting paper. In this form they can be packed quite easily into deep or narrow spaces, and the plasticity of the wet material permits its being squeezed like a rather thick paste into various irregular corners. I have not attempted suturing sheets of the material over large surfaces, but I believe from my experience with the behavior of oxidized gauze that such stitches would rapidly cut out as the material fell to pieces.

The blackening that takes place on exposure to blood was observed in all the cases here recorded, and appears to be a preliminary to the softening just described.

There appears to be no doubt of the value of oxidized gauze as a hemostatic agent, and this was very obvious at operation, but whether it is the result of a mechanical or chemical effect, or possibly both, the cases here described do not serve to show.

In this series there did not appear to be any adverse effects from using sulfathiazole in a wound in which oxidized gauze packs had been placed, and it is concluded that the use of sulfathiazole did not alter materially either the pH of the blood serum in the wound or the solubility of the packing material. On theoretical grounds it might be reasonable to expect sulfathiazole to lead to an increased alkalinity of the serum, but this scarcely finds confirmation in the results noted.

TABLE II. DETAILS OF WOUNDS AT REOPENING

CASE	SEX	AGE (YR.)	STAGE	SULFATHIAZOLE USED?	WOUND HEALING, AND CONDITION AT REOPENING	AMOUNT OF SERUM IN WOUND AT REOPENING	APPEARANCE OF WOUND AT REOPENING	QUANTITY OF OXIDIZED GAUZE LEFT UNABSORBED (%)	REMARKS
1. O. F.	M.	49	1st	Yes	Perfect at 7 days; all muscles solidly united at 21 days	1 oz.	Healthy and not inflamed	10	Tissue had healed over remains of oxidized gauze; fever 2 days
2. S. C.	M.	18	1st	No	Perfect at 7 days; deep tissues all solidly healed at 21 days	Nil	Wound space completely obliterated with healthy tissue	?	Irregular, but not high temperature for 2 weeks
3. F. C.	M.	26	1st	Yes	Perfect at 7 days; muscles firmly healed at 21 days	2 oz.	Inflammatory reddening, but clear serum	30	7 oz. serum aspirated from wound; temperature not higher than 99.6° F.
4. A. A.	M.	24	1st	Yes	Good at 7 days; slight stickiness of 3 or 4 upper stitch holes	This patient never came to reoperation since he developed a spread of the lung lesion and further surgery was held up; aspirated serum perfectly clear			Considerable fever for 2 weeks due to spread
5. V. D.	M.	28	1st	Yes	Perfect at 7 days; deep tissues all solidly healed at 21 days	Nil	Wound space almost completely obliterated and quite healthy	?	Highest postoperative temperature 99.6° F.; all oxidized gauze had been healed over
6. R. F.	M.	41	1st	No	Good at 7 days; stickiness of lower 3 stitch holes; muscles well healed at 21 days	Nil	Dry wound with many adhesions; quite healthy	50	2 days' temperature once to 101° F.
7. M. M.	F.	16	1st	Yes	Perfect at 7 days; muscles firmly healed at 21 days	2½ oz.	Fibrin bands in a healthy wound	10	5 days' postoperative temperature once to 103° F.

Reference to Table II will show that wound healing was complete and firm in all patients. The quantity of serum present in the wounds varied from nothing to three ounces but was not enough to call for aspiration except in one patient, in whom seven ounces were removed.

The appearance of the wound described for one patient (Case 3, Table II) cannot be regarded as evidence of any untoward effect of the oxidized gauze since we have not infrequently encountered such reactions in patients who have had nothing but sulfathiazole placed in the wounds, and we have felt that the reaction probably occurs in sulfa-sensitive patients.

The other six wounds were completely healthy in appearance and showed no evidence whatever of reaction to a foreign substance. As has already been remarked, two of them (Cases 2 and 5), were more thoroughly and firmly healed than is usual, and in these two patients the areas into which the oxidized gauze had been packed were so completely closed that it was not possible, without breaking down healthy tissue, to find remnants of the packing.

In view of the known solubility of oxidized gauze in mildly alkaline media, it is interesting to note that in both the patient (Case 3) in whom 30 per cent was unabsorbed at the end of three weeks, and in the patient (Case 6) in whom 50 per cent remained unabsorbed after the same time, the pH of the wound serum after two weeks was distinctly on the acid side. Nevertheless, these two patients had quite normal courses without any evidence of harm, and there is no doubt that the residues of the packs would have been absorbed in due course had they not been removed at subsequent operations.

Nothing particular was anticipated from the parallel blood studies, and nothing appears to have emerged as a result of them.

Two patients had very high wound serum leucocyte counts after one week, but while one of these (Case 3) showed the wound reaction already noted, the other (Case 1), with an even higher count, showed no abnormality at all.

The residue of oxidized gauze found in wounds after three weeks consists of a dark brownish, rather gelatinous, amorphous mass, removal of which at subsequent operation appears to be quite unnecessary.

CONCLUSION

Oxidized gauze (soluble cellulose) is a distinctly valuable addition to the hemostatic armamentarium. It provides, in an easily handled form, a packing material which can be safely left in a wound with no fear of its remaining as an irritating or permanent foreign substance.

Its use in clean wounds does not delay the healing, nor does it interfere with the strength of union of tissues.

When soaked with blood it has no strength of fiber, but rapidly becomes a sticky mass which is admirably adapted to packing deep narrow cavities either in soft tissues or in relation to raw bony surfaces.

I can express no opinion upon its suitability for use in contact with serous membranes, nor am I in a position to say what effect it might have in the presence of deep sepsis in a surgical wound. I have no doubt at all, however, of its value in the type of wound described in this communication.

PARTIAL CLAVICULECTOMY AS AN ADJUNCT TO SURGICAL COLLAPSE OF THE CHEST WALL

ADRIAN LAMBERT, M.D.
NEW YORK, N. Y.

EXTRAPLEURAL thoracoplasty and Schede thoracoplasty with unroofing of the wall of the chronic empyema cavity have been used with effect in certain chronic empyemas. Obliteration of the saucerized space left following Schede thoracoplasty has been assisted by the use of muscle graft implantation, the scapula frequently being used to obliterate the space posteriorly where the empyema space is complete and extends to the lumbar gutter. Partial scapulectomy has been of value in allowing the surrounding tissues to fill in the residual space. In such cases, the scapula impinges upon stumps of transverse processes and ribs posteriorly or upon the plaque of regenerated ribs and pleura at the apex of the chest. In certain cases of chronic empyema, however, difficulty has been encountered in obliterating the space in spite of the foregoing procedures. In these cases, the space extends from the apex of the pleural cavity beneath the clavicle to the lateral portion of the upper part of the chest and is held open by the clavicle. Removal of the first rib and its underlying parietal pleura fails to effect collapse because the extrathoracic tissues are held out by the clavicle anteriorly. The clavicle tends to rotate posteriorly following removal of the first rib and, in so doing, some elevation of the shoulder occurs. However, the length of the bone prevents approximation of the shoulder girdle to the chest wall and, if infection is present in the space between, healing will not take place. Similarly, in subscapular space infections following thoracoplasty either for empyema or for pulmonary disease, drainage may persist for a long period of time due to failure of the subscapular space to obliterate. In such cases, the infection is confined to a space, the internal limits of which are the collapsed chest wall, the external limits of which are scapula and extrathoracic muscles.

With this in mind and as an adjunct to the aforementioned collapse procedures for obliteration of the infected space, it was felt that if claviculectomy were performed to approximate the shoulder girdle to collapsed chest wall, the size of the infected space would be diminished and eventually become obliterated. This procedure has been undertaken in three patients, in all three of whom the infected space has been diminished in size. In two of these the infection in the pleura was reduced to a small residual sinus and in the third the extrapleural subscapular space was reduced in size.

The procedure itself is a simple one. An incision is made directly over the clavicle extending from the sternoclavicular junction to the acromioclavicular articulation. The incision is deepened through the platysmal layer down to the periosteum over the clavicle. This membrane is carefully freed from the clavicle so that after the bone has been removed the periosteal bed remains. A small

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section of the bone is left anteriorly for the attachment of the sternocleidomastoid muscle, consisting of a segment measuring about one inch in length. After the clavicle has been divided anteriorly, it is then freed laterally and separated with scissors from its attachment to the acromion. No bleeding of consequence is encountered during the procedure. The residual bed of periosteal tissue is then closed with sutures, following which a subcutaneous layer of interrupted sutures is placed to approximate the platysmal muscle. Interrupted sutures are used to approximate the skin, the wound being closed without drainage.

CASE REPORTS

CASE 1.—A 55-year-old man with a history of chronic tuberculosis, since 1939, had developed a tuberculous empyema on the right side following pneumothorax. This had become secondarily infected necessitating rib resection and drainage in 1940. The tube was left in for three years, following which the patient underwent three stages of thoracoplasty, including eleven ribs, on Feb. 3, Feb. 18, and March 10, 1943. Schede thoracoplasty performed April 21, 1943, was followed by a second Schede thoracoplasty July 13, 1943. Numerous skin grafts were used to epithelize the lower aspect of the visceral pleura. On Jan. 19, 1944, scapulectomy was performed in an attempt to obliterate the pleural space posteriorly. At that time 80 per cent of the scapula was removed, leaving only portions around the glenoid and the lateral portions of the spine. It was felt that the clavicle was responsible for persistence of the space, therefore on April 29, 1944, the patient underwent subtotal claviculectomy on the left side. The patient withstood the operation well and was able to move his arm immediately after the operation as much as before. The shoulder, which had fallen in a great deal, obliterated the upper portion of the remainder of the pleural space. Following the operation, the patient received a course of penicillin, chlorodiazine locally, two courses of penicillin and red wash applied locally, following which, on Dec. 5, 1944, a portion of the latissimus dorsi was inserted upward to help obliterate the posterior angle of the space. The patient was then given physiotherapy and was discharged home May 2, 1945, for treatment in the clinic of a small residual sinus. When last seen in January, 1946, the patient was progressing satisfactorily. He had full use of his arm with only limitation of abduction past 100 degrees which he had lost following the original thoracoplasty operation.

CASE 2.—A 37-year-old Chinese man had a history of tuberculosis since July, 1939, for which he received pneumothorax on the right side in November, 1939, with conversion of sputum. The patient was admitted in May, 1944, with tuberculous empyema. Repeated attempts at re-expansion by thoracentesis proved unsuccessful, and on July 5, 1944, the patient underwent thoracoplasty. He had an extremely stormy course, it being necessary to subject him to five stages of thoracoplasty before the chest wall could be collapsed. Schede thoracoplasty was instituted Nov. 21, 1944, the second stage being performed through an axillary incision Jan. 6, 1945. Phrenic nerve crush was performed Feb. 27, 1945, resulting in an elevation of the diaphragm that helped to diminish the lower aspects of the empyema space. Since it was felt that the space was being held out anteriorly and posteriorly by the clavicle, subtotal claviculectomy was performed, April 3, 1945. The patient withstood the procedure well and was able to move his arm in all directions after the operation. The wound healed by primary union. Following the procedure, considerable falling in of both anterior and posterior axillary folds occurred, with marked diminution of the empyema space anteriorly. Examination on June 13, 1945, revealed a small slitlike space into which a probe could be passed. This has persisted posteriorly to the present time, although it has become progressively smaller. It is felt that an impingement of the scapula upon the posterior spine has been responsible for the slow obliteration of the posterior space.

CASE 3.—A 42-year-old man had a history of chronic pulmonary tuberculosis since October, 1943. Pneumothorax was begun on the right side in January, 1944; since that time sputum had been negative. The patient developed a tuberculous empyema in October, 1944,

Fig. 1.—Roentgenogram shows chest collapsed on the left side following extrapleural thoracoplasty and Schede thoracoplasty. The residual space is limited by scapula posteriorly and clavicle anteriorly.

Fig. 2.—Partial scapulectomy has been performed with resultant elevation and displacement posteriorly of clavicle and slight approximation of shoulder girdle to chest wall. Posterior space was reduced by this procedure.

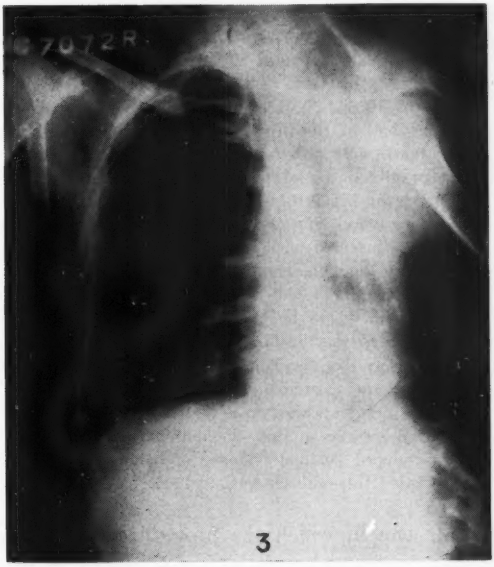

Fig. 3.—Clavicle has been removed, which has resulted in considerable falling in and some lowering of the shoulder girdle to obliterate the apex of residual pleural space.

Fig. 4.—Roentgenogram shows clavicle regenerated six months after removal; motion at shoulder is limited only in abduction, otherwise power of movement is normal.

for which he underwent a pack thoracoplasty March 9, 1945. At that time, the first and second ribs were removed completely. The third, fourth and fifth were stripped, and a penicillin-impregnated gauze pack was placed between these ribs and the parietal pleura and intercostal muscles and rib beds beneath. The sixth, seventh and eighth ribs were removed completely at this time. On March 20, 1945, a second stage thoracoplasty was performed with removal of the packing and of the third, fourth and fifth ribs that had been previously stripped. The ninth and tenth were also removed to complete the thoracoplasty. Following this, in spite of local and systemic use of penicillin and sulfonamide, the wound became infected, necessitating drainage on April 12, 1945. The empyema was also drained April 23, 1945, following which tuberculous infection appeared in the subscapular space. As the thoracoplasty wound had been infected with tuberculosis and the subscapular space was held out by the clavicle, it was felt that claviculectomy might aid in diminishing the size of the subscapular space, and on June 1, 1945, this was performed. Postoperatively, the patient had some swelling of the right arm where he had an intravenous infusion at the time of the operation. Postoperatively, there was an immediate falling in of the shoulder girdle with a diminution of the subscapular space. The involvement of the thoracoplasty wound with tuberculosis, however, caused the posterior portion of the wound to break down, with separation of the rhomboid and trapezius muscles. The arm and shoulder descended considerably farther than was necessary so that the patient had to use a sling to support the arm. The patient since developed further evidence of hematogenous tuberculosis and finally died of generalized disseminated tuberculosis Aug. 3, 1945.

Case 3 represents one in which the procedure of subtotal claviculectomy should not have been performed. Following the removal of the clavicle, the shoulder girdle will rely for support upon the trapezius and rhomboid muscles. Should these not be intact, there will not be sufficient support of the shoulder girdle to hold up the arms. In this patient, the muscles separated as the wound became more infected, which resulted in impairment of circulation in the arm and abnormal fall of shoulder. This is one pitfall that would have been avoided if the significance of the muscular support of the shoulder had been fully appreciated.

DISCUSSION

Following removal of the clavicle, there is an immediate descent of the shoulder and scapula with an approximation of the shoulder girdle to the chest wall. Motion in the arm occurred to the horizontal level of abduction with full strength of motion in the shoulder girdle in the two patients who survived the disease. The clavicle regenerates at the site of its periosteal bed in an irregular form analogous to the appearance of regenerated rib. In the patients in whom the trapezius and rhomboid muscles were intact, there occurred no brachial plexus symptoms or impairment of circulation of arm because of arterial constriction or venostasis. Following the third case, the importance of intact trapezius and rhomboid muscles in support of the shoulder was realized. In this patient, these muscles broke down and separated after the thoracoplasty wound became infected with tuberculosis and adequate support was not maintained for the arm. Circulation in the arm, after separation of these muscles, became impaired and as such represented a contraindication of the procedure in patients in whom these muscles are not intact. The man (Case 3) died soon after from disseminated tuberculosis.

In all patients, there was marked diminution of the size of the infected space as the shoulder girdle fell in to approximate the chest wall. With the clavicle absent, there is more deformity on the operated side than there is with it intact, the shoulder being appreciably lower and closer to the chest wall than it is on the normal side.

SUMMARY

Three cases of patients with chest wall infection are reported, in which subtotal claviculectomy was resorted to in order to help obliterate the residual infected space. In all three cases the procedure was utilized as an adjunct to previous collapse measures. In two patients the pleural space and in one the subscapular space was held out by the clavicle, and in all three the infected space was markedly diminished in size following claviculectomy. Arm motion and circulation were preserved in the upper extremity following the operation. Support of the shoulder following claviculectomy will depend on the trapezius and rhomboid muscles, therefore these should be intact before operation is undertaken.

MUCOCELLULAR PAPILLARY ADENOCARCINOMA OF THE LUNG AND LOBECTOMY

KERMIT E. OSSERMAN, M.D., AND HAROLD NEUHOF, M.D.
NEW YORK, N. Y.

MUCOCELLULAR papillary adenocarcinoma of the lung is uncommon, and a review of the literature reveals nineteen cases, all of which were diagnosed at autopsy. This type of tumor has been classified by various authors under many different terms, such as alveolar cell tumor,[1] primary cancer of the lung,[2] adenoma,[3] papillary gelatinous adenocarcinoma,[4] alveolar epithelial cancer,[5] multicentric alveolar carcinoma,[6] adenomatosis,[7] etc.[8-18]

Neubuerger and Geever,[1] in 1942, in an excellent review, have classified all these types as alveolar cell tumor of the lung whether or not they are mucus-producing. The alveolar cell tumor arises either as a multicentric nodular neoplasm or as a diffuse infiltrating growth; combinations of both types are occasionally observed.

The lungs are greatly increased in weight. In the nodular type, the nodules vary from miliary to marble size and are yellowish gray, pink, or white, with fairly sharp borders. The nodules are discrete, or fused to form larger masses. Mucinous secretion is present. The diffuse form is characterized by involvement of a lobe or an entire lung on one or both sides. The appearance simulates lobar pneumonia in the stage of gray hepatization.

Metastases are not a prominent feature. In six of the nineteen cases reported there were no metastases. There was involvement of hilar and bronchial lymph nodes in five, and in four cases metastases to the gastrointestinal tract, brain, and pericardium were noted at autopsy. In four cases there was no statement made regarding the presence of metastatic lesions.

The microscopic picture of the nodular and diffuse forms is identical and, in fact, Malassez'[8] description in 1876 adequately describes the histology. The tumor stroma is made up of the alveolar walls. The latter are lined by cuboid or columnar neoplastic cells in one or more layers. Papillary protrusions of such cells are frequent. Nuclei are pale or hyperchromatic. Mitotic figures are fairly frequently present. Mucinous secretion is present.

Clinically, the picture depends upon whether the lesion is nodular or diffuse. A study of the clinical records revealed no distinctive symptoms.[1] In some cases a diagnosis of pulmonary tuberculosis was made; in others, the course was rapid and the impression was one of lobar or bronchial pneumonia. The majority of the patients did not survive more than one year. However, there are reported cases in which this variety of cancer of the lung was discovered as an incidental finding at autopsy, leading to the thought that the duration was appreciably longer than that suggested by the clinical history.[7] Occasional symptoms are cough, hemoptysis, cyanosis, or pain in the chest with

From the Surgical Service and the Department of Laboratories, the Mount Sinai Hospital.
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evidence of pleural effusion. Some reports refer the presenting symptoms to tumor metastases for example, those in the brain, stomach, or liver.[9] Metastases occur most often in the multiple nodular form and therefore a primary neoplasm elsewhere must be ruled out. The diffuse type tends to spread throughout the lung and to the other lung. Bronchoscopic examination does not reveal the presence of a tumor.

In the records of the Department of Morbid Anatomy of the Mount Sinai Hospital, there are three cases which present the characteristic microscopic features of mucocellular papillary adenocarcinoma. The case which we are reporting in detail is unusual in that the symptoms of illness were of three years' duration before the patient came to our attention, and that since lobectomy was performed, there has been no evidence of recurrence for two years. The second patient was a woman, 45 years of age, and the duration of illness was ten months. The clinical course was that of chronic pneumonia with recurrences and exacerbations, and the diagnosis was recurrent pneumonitis. During the course of illness the disease spread from the left lower lobe to involve virtually all the lobes of both lungs. Bronchoscopy on two occasions was negative, as was bronchography. At post-mortem examination the typical picture of mucocellular papillary adenocarcinoma was revealed. The third case was of the nodular type and at autopsy a small metastatic nodule was found in the opposite lung.

CASE REPORT

R. M., a 44-year-old woman, was admitted to the Mount Sinai Hospital for the first time with the chief complaint of cough of three years' duration. The family history was noncontributory. She was studied in the Consultation Service of the Mount Sinai Hospital in 1936, complaining of generalized pain, increasing lassitude, and recurrent attacks of coryza. Physical examination at the time was completely negative, including fluoroscopy of the chest. A diagnosis of psychoneurosis was made. The present illness started three years before admission (1941) with cough, which was nonproductive. She did not seek medical advice until one year later, when she was told she was anemic. The cough was thought to be caused by a postnasal drip. In February, 1943, the patient had an attack of coryza with slight fever and after recovery was fluoroscoped at a doctor's office. She was told that she had a small "spot" in the left lung posteriorly. In August, 1943, a roentgenogram of the chest was made. The cough persisted and another roentgenogram was made in March, 1944. The patient was told she had a chronic pneumonitis. In March, 1943, the cough became productive of foamy greenish-yellow sputum without odor. There was no hemoptysis. There had been no afternoon fever or loss of weight. She had been dyspneic since the onset of the present illness, had occasional hoarseness, and tired easily. She first came to our attention in October, 1944.

On physical examination the patient was found to be a well-nourished, white, adult woman, not acutely ill. Conjunctivae were slightly pale. Eyes, ears, nose, and throat were otherwise negative; the thyroid was normal. The trachea was in midline and there was no lymph adenopathy. The heart was normal in size, shape, and position. The lungs were clear and resonant, until the left scapula was raised, when an area of dullness without râles was detected at the level of the fifth thoracic vertebra. Abdominal, pelvic, and neurologic examinations were negative. There was marked clubbing of the fingers. Fluoroscopy revealed some increased density of the left lower lobe. The diaphragms moved freely. The hemoglobin was 72 per cent, the urine was negative, and the blood pressure was 120/80.

The roentgenograms of the chest made fourteen months before admission to the hospital dated Aug. 5, 1943, showed a homogeneous density in the left lower lobe apparently

reaching to the region of the interlobar fissure. It was fairly sharply circumscribed inferiorly (Fig. 1). Another roentgenogram made Mar. 25, 1944, showed some downward extension of the lower border and the upper border appeared lobulated (Fig. 2). On Oct. 6, 1944, there was noted a clouding of the lower half of the left lung field with further lobulation of the upper border of the density (Fig. 3).

An exploratory thoracotomy was performed in November, 1944. At operation, the left lower lobe was found to be greatly enlarged and firm. On frozen section a biopsy revealed mucous adenocarcinoma. There was no gross involvement of the pleura or any of the hilar lymph nodes. A dissection type of lobectomy of the left lower lobe was performed. The phrenic nerve was severed.

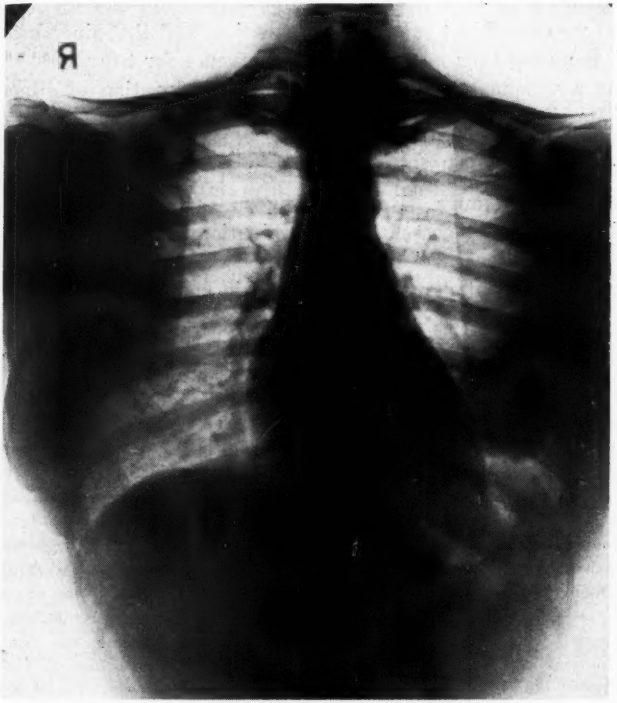

Fig. 1.—August, 1943, a circumscribed homogeneous shadow in the region of the left lower lobe.

The patient made an uneventful recovery. A postoperative roentgenogram of the chest revealed marked elevation of the left diaphragm. The left upper lobe was clear. There was no displacement of the mediastinum and the right lung was also clear.

Gross pathology (Fig. 4) revealed that the specimen was a lower lobe which was greatly enlarged in its lower two thirds by the presence of a firm mass which bulged over the surfaces on its basal and axillary portions and differed from the surrounding compressed lung tissues by its grayish color. Only small portions of the lung were still aerated. The mass was incised and appeared on section as a mucus-containing, apparently cellular tumor which completely replaced the lung tissue. The large bronchial branches leading into the lung were pushed toward the pleural surfaces. No large bronchial branches could be seen within the tumor. There were a few anthracotic lymph nodes within the hilus, which did not seem grossly involved.

Microscopic pathology (Figs. 5 and 6) showed that the tumor consisted of glandular structure lined by mucus-containing cylindrical epithelium. This glandular structure, however, often presented papillary projections into the lumen, and the nuclei of the epithelium were located at the base close to the basement membrane.

A most striking histologic feature of this tumor was an overproduction of mucus which split up the glandular structure and produced a unique picture resembling pseudomyxoma peritonei. The tumor presented no fibrous stroma and the mucous epithelial cells appeared to be actually in the alveolar walls, that is, the basement membranes of the glandular structures were made up of alveolar walls. Extreme mucus production was seen in the peripheral zone of the tumor where there were markedly distended alveolar lumina, as in emphysema, filled with mucus and occasional mucous tumor cells attached to the alveolar walls in groups. At the border of the tumor the alveolar spaces were actually filled with mucus without any tumor cells which, however, contained many phagocytic histiocytes. The nuclei of the mucous tumor cells were regular and mitotic figures were extremely rare.

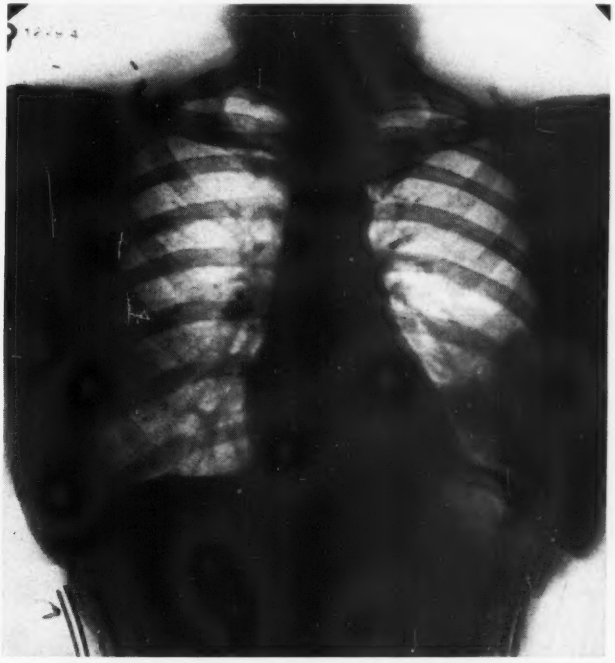

Fig. 2.—Mar. 25, 1944, there is a downward extension of the lower border, and the upper border appears lobulated.

Another unusual feature of the tumor was the presence of normal bronchial branches even within the center of the tumor mass, and scattered small foci of epithelial cells with occasional giant cells. The latter can be seen also within the normal portion of the lung tissue. Some of these foci contain anthracotic pigment.

The diagnosis was mucocellular papillary adenocarcinoma of lung, histologically of the type of the multicentric papillary adenocarcinoma.

The patient was discharged after five weeks. She subsequently developed some pain in the left upper extremity. No metastatic changes were found on repeated roentgenograms. The blood alkaline phosphatase was normal. At the present time, which is two years later, the patient is symptom-free, and has lost the clubbing of the fingers.

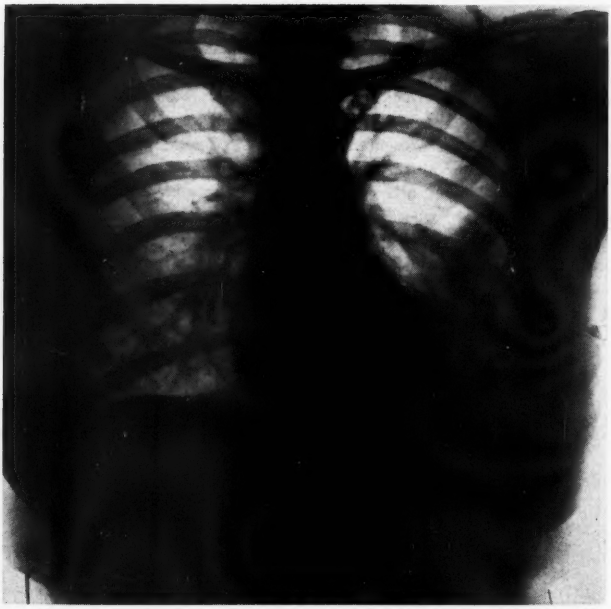

Fig. 3.—Oct. 16, 1944, clouding of the lower half of the left lung field with further lobulation of the upper borders of the shadow.

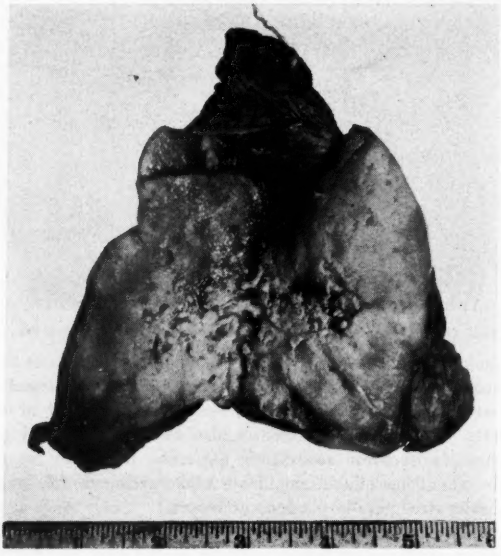

Fig. 4.—Gross pathology showing a mass in the lower two thirds of the left lower lobe which bulges over the surfaces on its basal and axillary portions.

Fig. 5.—Low-power photomicrograph showing glandular structure with papillary projections into the lumen.

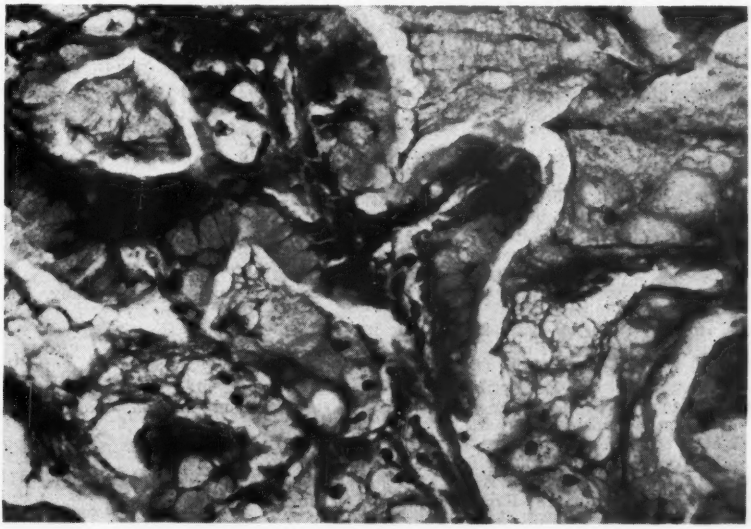

Fig. 6.—High-power photomicrograph showing the striking mucus production and the basement membranes of the glandular structures made up of the alveolar walls.

DISCUSSION

Owing to the variations in the literature concerning terminology in reporting mucous cell cancer of the lung it is virtually impossible to ascertain the incidence of this lesion. According to Neubuerger and Geever,[1] who attempted a classification of the reported cases according to histology, it is apparent that this type of tumor is not excessively rare. Indeed, they believe that about 5 per cent of all primary cancers of the lung are of this variety. On the other hand, it is also apparent that not a few of the cases in their collection are not sufficiently well documented to be sure that they belong to this group. The difficulty becomes greater when an attempt is made to ascertain what, if any, distinctive features characterize this relatively rare form of cancer of the lung. Some cases are reported to be extremely malignant and of short duration and others are of comparatively long duration. There is no case reported which has the topographical features of our case and this is perhaps the reason that our case is the only one in which lobectomy rather than pneumonectomy has been employed as a cure for the lesion. If we may generalize from the particular case it would appear that a long-standing unproductive cough, clubbing of the fingers, and a roentgenogram of the chest revealing a shadow with some suggestion of lobulation appear to comprise a triad pointing to a circumscribed type of cancer of the lung which may prove to be of the mucous cell type. Should bronchoscopy in such a case yield positive results it would be more in the nature of an accident of erosion of the tumor into one of the larger bronchi. The fact that the patient has done well up to the present time with the relatively simple procedure of lobectomy emphasizes the circumscribed and well-localized type of tumor. The latter involved almost the entire lobe in this case, but could nevertheless be eradicated by lobectomy with a satisfactory follow-up two years after operation.

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FATE OF THE DISTAL ESOPHAGEAL SEGMENT FOLLOWING THE INDIRECT SURGICAL TREATMENT OF A CONGENITAL TRACHEOESOPHAGEAL FISTULA

WILLIAM P. LONGMIRE, JR., M.D.
BALTIMORE, MD.

INTRODUCTION

THE purpose of this brief communication is to describe the condition as found at autopsy of the distal esophageal segment in a patient with congenital atresia and a tracheoesophageal fistula, two years and ten months after the oral segment had been exteriorized and the aboral end ligated above the diaphragm.

REVIEW OF THE LITERATURE

After reviewing the reports of uniformly unsuccessful primary end-to-end suture of the esophagus in cases of esophageal atresia with tracheoesophageal fistula, Carter,[1] in 1941, recommended a method of indirect surgical treatment of this anomaly. At the first operation the upper segment of the esophagus is brought out above the clavicle and opened. At the second stage the cardia of the stomach is mobilized and the distal portion of the esophagus is pulled down through the diaphragm, ligated, and divided as high in the mediastinum as possible. The portion of the esophagus which remains attached to the stomach is exteriorized to serve as a "gastrostomy." This operation is a modification of a method previously described by Gage and Ochsner.[2]

Whether the retained blind segment of esophagus in communication with the trachea would eventually atrophy and close, whether it would become a saclike structure filled with its own secretions, or whether these secretions would empty into the trachea in sufficient quantities to cause pulmonary complications are questions which remained unanswered. In the operation recommended by Carter an attempt is made to eliminate as much of the pouch as possible. In recent years several cases of successful end-to-end anastomosis have been reported, and exploration of the site of the atretic segment of the esophagus is now usually recommended (Haight,[3] Poth,[4] Ladd,[5] Daniel[6]). At this exploration the fistula is closed near the trachea even though primary anastomosis may not be feasible. Exploration of this region in infants with tracheoesophageal fistula is a formidable procedure which at times may be contraindicated.

CASE REPORT

T. E. H., a 4-day-old boy, with atresia of the esophagus and a tracheoesophageal fistula was operated upon on Sept. 8, 1942, under local anesthesia by another surgeon. Through an incision anterior to the lower portion of the left sternocleidomastoid muscle,

From the Department of Surgery of the Johns Hopkins School of Medicine and the Johns Hopkins Hospital.
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the dilated blind pouch of the esophagus was delivered into the wound unopened. An upper left rectus abdominal incision was then made. The esophagus was freed up through the diaphragm, doubly ligated with heavy silk ligatures as high as possible, and divided between the ligatures. The lower end of the esophagus was brought to the outside through the upper angle of the incision.

During the ensuing two years and ten months that the infant lived there were many complications, most of which were entirely unrelated to the esophageal anomaly. He had numerous bouts of unexplained fever with the temperature rising to 42° C., but there was never any evidence to indicate that the fever was related in any way to the esophageal pouch or to a pulmonary infection. Repeated x-ray and fluoroscopic examinations on at least fifteen occasions did not show any abnormality of the mediastinal shadow or of the lung fields. Throughout the patient's life there was a persistent, harsh, brassy, nonproductive cough which at times was severe enough to require sedation. It was believed that this might have been caused by the emptying of the secretions of the esophageal pouch into the region of the bifurcation of the trachea. The infant died on July 2, 1945, of a blood stream infection caused by *Bacillus pyocyaneus.*

Fig. 1.—Autopsy specimen showing esophageal segment opened to show size and development of this structure and fistula into trachea. Esophageal ligature can be seen in lumen of esophagus just above diaphragm.

Autopsy.—The autopsy reports* showed that the oral end of the esophagus was narrow and ended in a fistulous opening in the left supraclavicular region. The fundus of the small contracted stomach formed a blind sac beneath the left side of the diaphragm. The lower portion of the mediastinal esophagus was 5.5 cm. long and ended blindly above the diaphragm. It was somewhat dilated in its lowermost portion and contained a small amount of black

*By Dr. J. D. Kennedy, Dr. Ella H. Oppenheimer, and Dr. S. Blackman.

mucoid material. A black silk ligature partially embedded in a small mass of scar tissue protruded into the distal end of the lumen of the esophagus. The opening of the upper end of this esophageal segment into the posterior wall of the trachea just above the bifurcation measured 5 mm. in diameter. The wall of this segment was of normal thickness and texture. Other than a small amount of scar tissue about the distal end there was no evidence of infection or scarring (Fig. 1). The lungs were air containing and the bronchi showed no abnormalities.

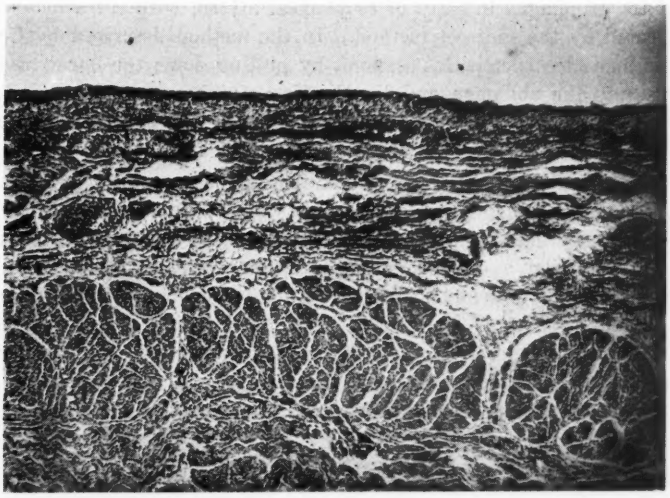

Fig. 2.—Photomicrograph of distal esophageal wall showing intact mucosa and normally developed musculature.

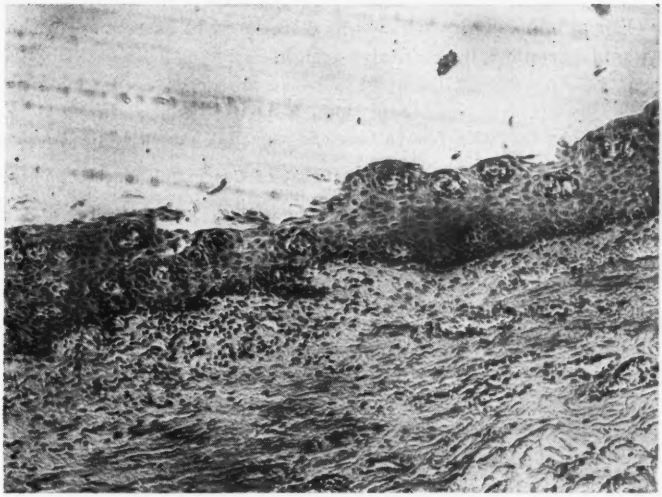

Fig. 3.—High-power photomicrograph of esophageal wall showing small area of round-cell infiltration. No other signs of inflammation or scarring are seen.

On microscopic examination, the structure of the esophageal wall was seen to be normal except for a very slight round-cell infiltration in the mucosa and musculature. The mucous membrane was intact and the muscular layers were normally developed. There were no signs of atrophy, scarring, or infection (Figs. 2 and 3).

SUMMARY

It has been suspected that complications might arise from the lower blind pouch of the esophagus in cases of esophageal atresia with a tracheoesophageal fistula treated by the indirect method. In the method described by Carter an attempt is made to shorten this segment by pulling down the lower mediastinal esophagus into the abdomen and ligating it as high as possible. It has been impossible to find any information in the literature concerning the fate of this segment after the immediate postoperative period.

In the patient described, who lived for two years and ten months after operation, the lower esophageal segment was a well-developed structure. The wall appeared normal both grossly and microscopically except for a slight round-cell infiltration, and there was no evidence of mediastinitis. The opening into the trachea was patent; no undue accumulation of the mucosal secretions in the pouch was seen. The persistent nonproductive cough was the only clinical symptom arising from the retained esophagus. There was never any evidence, before death or at autopsy, that the fistula was responsible for the frequent bouts of unexplained fever which occurred throughout the patient's life.

CONCLUSION

The lower esophageal segment in a case of esophageal atresia with a tracheoesophageal fistula retained the characteristics of a normal portion of the esophagus for two years and ten months after its ligation above the diaphragm. The only clinical abnormality which was considered to be related to the retained segment was a chronic nonproductive cough.

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INTRATHORACIC GOITER

Report of a Patient Operated Upon Through the Thorax

Colonel Henry G. Hollenberg, Medical Corps
Army of the United States

EXCEPT for the exceedingly rare aberrant goiters in the chest, intrathoracic goiters begin their growth as nodules in the lower pole of a lateral lobe or, occasionally, in the isthmus. They readily descend in the potential space in which the thyroid gland normally lies between the precervical and pretracheal fascial planes. This space extends deep into the mediastinum. For a time some of these nodules ascend and descend. They are of the so-called diver type.

The downward extension of any type of goiter to a point merely behind the sternum and clavicle and with its larger diameter above the clavicle is, strictly speaking, merely a substernal or incomplete intrathoracic goiter. True intrathoracic goiters are those whose greater diameter is below the clavicle. It is quite common that this diameter is greater than that of the superior thoracic strait. Such goiters are nearly all of the nodular type. Mixed nodular and colloid goiters may assume this position. Malignant changes of course may occur in these intrathoracic goiters.

The high frequency of goiter tissue in this position is now well known and the necessity of having chest roentgenograms in all patients having nodular goiter is well appreciated. Such roentgenograms are indeed advisable in all patients with any type of goiter, and certainly in individuals presenting complaints or symptoms which might be due to pressure of such a mass in the upper thorax, even though there be no positive indication of goiter on physical examination.

The removal of these goiters has always posed something of a problem for surgeons. Incomplete intrathoracic ones and those of the diver type are readily delivered into the neck at operation and are easily handled. It is the true intrathoracic ones which cause real difficulty.

Anatomic Consideration.—Nodules which have descended into the chest retain their anatomic attachments in the neck. In assuming their new position they usually alter the normal position of some structures and encroach upon others. In any thyroid operation one is technically concerned with arteries and veins, parathyroid glands, recurrent laryngeal nerves, the thoracic duct on the left, the trachea, etc. Inasmuch as intrathoracic goiters usually originate from the lower pole of the lateral lobes, or occasionally from the isthmus, one is concerned for the purposes of this discussion with structures intimate to this portion of the gland. It will be recalled that the inferior thyroid artery arises from the thyrocervical trunk of the subclavian artery on each side. The single

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thyroidea ima artery arises most commonly from the innominate artery although occasionally from the aorta, from the right common carotid artery, or from the internal mammary. The inferior thyroid veins empty into their corresponding innominate arteries. Middle thyroid veins enter into the lower part of the internal jugular vein on each side. The recurrent laryngeal nerve on the right side arises from the right vagus and passes beneath the subclavian artery from before backward. On the left side, the recurrent laryngeal nerve arises from the vagus and passes under the arch of the aorta from before backward and at a lower level than on the right. These nerves then ascend along the lateral side of the trachea, and in the presence of goiter may be deflected. As Lahey[1] has pointed out, however, an intrathoracic goiter always retains a position anterior to the nerve and to the inferior thyroid artery. The lower parathyroid glands normally lying on the lower posterior surface of the capsule may likewise be displaced laterally or into the chest. The thoracic duct in the upper portion of its course "performs an arch which arises three or four centimeters above the clavicle and crosses anterior to the subclavian artery, the vertebral artery and vein, and the thyrocervical trunk or its branches. It passes in front of the phrenic nerve and the medial border of the scalenus anterior muscle but is separated from these structures by the prevertebral fascia. In front of it are the left common carotid artery, the vagus nerve and the internal jugular vein. It ends by opening into the angle of junction of the left subclavian vein with the left internal jugular vein."[2] This structure is therefore posterior to all intrathoracic thyroid glands and is separated from them by the prevertebral fascia. Damage to the structure would only result from a dissection through the fascial plane. The proper handling of these blood vessels and other structures is of course of vital importance, no matter what the approach to any goiter.

Even the largest intrathoracic goiters can ordinarily be removed through the usual collar incision. Glands having a considerably larger diameter than the superior thoracic strait can be manipulated upward by traction from above and blunt dissection around them. Such a procedure is safe, inasmuch as the origin of the blood vessels is under good control after the nodule is delivered into the incision. In those instances where the goiter is too large for such manipulative removal, the procedure of morcellation is utilized. This consists in the removal of a portion of the interior of the gland by curetting and suction, thereby reducing its size. The remaining outside portion, being virtually an intact sac, can then be delivered.

Under exceptional circumstances all of these procedures will fail or will be deemed inadvisable to attempt when an operation is being planned. The removal of such a goiter through the thorax is by no means a new procedure but it is quite likely that it will henceforth be used more commonly in view of recent advances in all aspects of intrathoracic surgery. For obvious reasons, however, such a transpleural approach should only be considered under exceptional circumstances. Certainly in the case of a very low-lying goiter in the region of the diaphragm and with little or no mass apparent by x-ray examina-

tion higher in the chest, such an approach would be highly indicated. Such cases may or may not have goiter tissue in the neck. The case to be described presented indications which we felt pointed unmistakably to the advisability of such an approach. This patient had had three previous operations through the neck. At the third the sternum was divided longitudinally, in addition. In view of the obvious likelihood of adhesions of considerable density and because of the size of the goiter, it was felt that any approach through the neck or through the sternum would be difficult or unsuccessful (Fig. 1).

Fig. 1.—Photograph showing scars of three previous operations twenty-six, fifteen, and three years previously. At the third operation the sternum had been divided longitudinally. Because of the presence of this extensive scarring and the large size of the mass on the right, a transpleural approach was utilized. No goiter tissue was palpable in the neck.

CASE REPORT*

Mrs. I. A. W. (Bushnell General Hospital No. 19709), aged 55 years, the dependent mother of a soldier, complained of difficulty in breathing, particularly on exertion, shortness of breath, orthopnea, and general symptoms of fatigue. She had had three previous thyroid operations. These were performed twenty-six, fifteen, and three years previously. At the first two of these operations nodules were removed from the neck through a low collar

*This patient was referred to us by Colonel John B. Flick, who unfortunately could not operate upon her himself because of conflicting Army duties. He concurred in the mode of approach which was used.

incision. Later she began to have further difficulty and learned that there were intrathoracic extensions. At the operation three years before, an approach through the neck was again made and because of the presence of large intrathoracic masses on either side, the sternum was split longitudinally. The surgeon was able to remove completely the intrathoracic portion on the left, although he was unable to remove that on the right. Since this operation the remaining portion on the right has undoubtedly increased materially in size. She was improved by each of these operative procedures. General health has otherwise been quite good. There was a definite hoarseness of the voice, which she said had been present since early years and before any operative procedure. It was fully expected to find a paralysis of one vocal cord, but both moved normally. There was, however, chronic inflammation and thickening of both cords, which accounted for the abnormal tone of the voice.

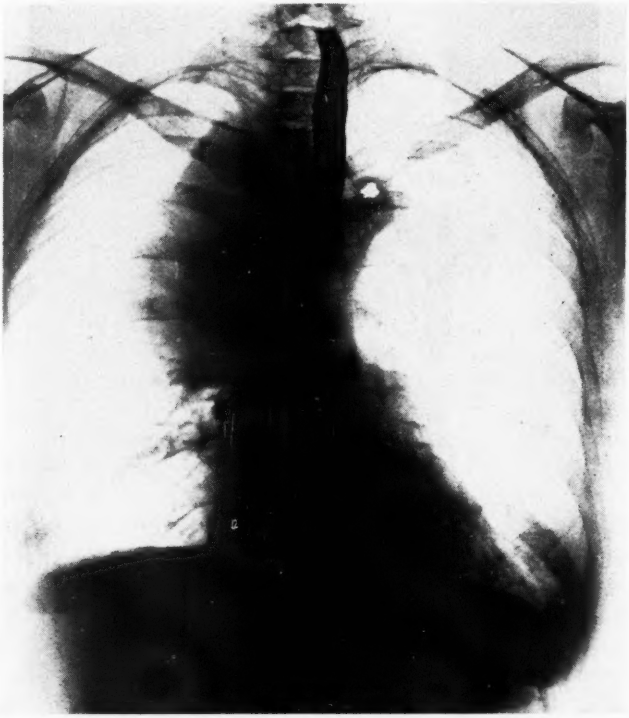

Fig. 2.

Figs. 2 and 3.—Anteroposterior and lateral roentgenograms showing the large mass on the right. A diagnosis of intrathoracic goiter was made on the basis of history and the deflection of the trachea, which is partly obscured in these views by the presence of barium in the esophagus.

There was no recurrence of goiter in the neck evident from physical examination. The basal metabolic rate was plus 15. Blood cholesterol was essentially normal, being 182 mg. per cent. Examination of the cardiac mechanism by physical examination and by electrocardiogram showed no significant abnormalities. The remainder of the physical examination was of no particular interest in connection with the goiter situation (Figs. 2 and 3).

Operation: An endotracheal tube was used and gas-oxygen-ether was administered through a closed system. A posterior lateral incision was made, resecting the sixth rib and entering the right thoracic cavity through the bed of this rib. The lung was not adherent. The tumor mass was readily palpated. An incision was made through the parietal pleura

overlying the tumor and it was readily separated by blunt dissection up to the small area of attachment in the neck. Excellent exposure was obtained through this incision and the operative field was under good control at all times. The right subclavian artery was immediately adjacent to the upper lateral portion of the mass. The tumor was completely removed largely by blunt dissection, with the necessity of clamping only one vessel of any appreciable size, which was taken to be the inferior thyroid artery. After removal of this large mass a smaller one (see Fig. 4) could be palpated in the neck and it likewise was readily shelled out separately and without any significant bleeding. It was felt that this smaller mass was at about the level of the sternoclavicular junction. The beds of both

Fig. 3.

(*For legend see opposite page.*)

masses were temporarily packed with moist sponges and were completely dry at the end of the procedure, it being necessary to tie off only a few small areas where bleeding occurred. Careful inspection of the tissue removed revealed no parathyroid glands and this was later confirmed by microscopic study of suspicious areas. All packs were removed and the pleura which had previously covered the tumor was closed loosely with interrupted sutures of fine cotton. The thoracic incision was closed using nonabsorbable suture material throughout, and without drainage. Immediately following the operative procedure the air was aspirated from the chest. The postoperative convalescence was uneventful except for the accumulation of a small amount of fluid which was aspirated on one occasion and found to be sterile.

Later convalescence was likewise satisfactory. Eleven months after operation the relief was striking. Blood calcium determinations were normal. The voice was not altered and laryngoscopic examination of the vocal cords after operation showed good mobility of them. The tissue removed was a mixed nodular and colloid goiter (Fig. 4).

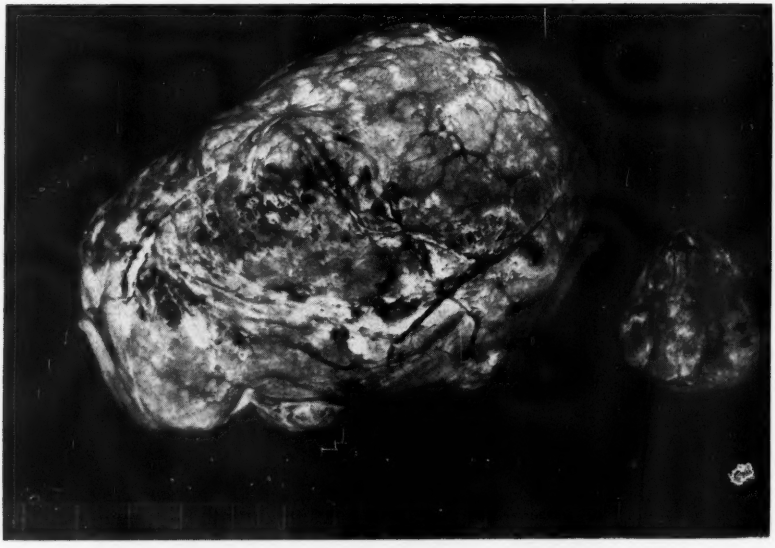

Fig. 4.—A mixed nodular and colloid intrathoracic goiter removed transpleurally. The larger mass was 6 by 4 by 4 inches in size. The smaller mass was separate and above at the level of the sternoclavicular juncture.

The operative procedure in this case was greatly simplified by the previous operations at which all goiter tissue in the neck had been removed. The goiter had essentially been separated from its connections within the neck except for the inferior thyroid artery. It probably would be definitely unwise to attempt the removal of thyroid tissue in the neck through this type of incision. Certainly the upper pole vessels would not be under control. If one is confronted with a case having extensive enlargement of thyroid tissue in the neck and likewise with a large portion within the chest which it would seem wise to approach in this manner, it would no doubt be better to remove the portion from the neck at the first stage, separating it from the intrathoracic gland, and at a second stage to remove the intrathoracic portion transpleurally. Under the very unlikely circumstance that there were bilateral intrathoracic goiters, neither of which could be removed through the neck, consideration would have to be given to some such procedure as a division of the sternum, or of facing bilateral transpleural approaches at two later sittings. Resection of the fifth rib might be superior to that of any lower one. Endotracheal anesthesia is, of course, of prime importance in operative procedures of this type, not only from the point of view of intrathoracic surgery in general, but also from that of the manipulation of a goiter of this size which has compressed and weakened the tracheal

walls. One needs to have some respect for the phrenic nerve on either side and for the thoracic duct on the left. Also, one should keep in mind the presence of the large vessels in the upper portion of the chest which are immediately adjacent to the upper portion of the goiter.

We have had no experience in the handling of a malignant degeneration of an intrathoracic goiter in the area by this approach. Certainly they cannot be removed from above. In view of the intimate attachments and ingrowths of such a tumor into neighboring structures it is unlikely that one of any extent could be successfully removed through this approach. If such malignancy were not too far advanced it might be possible. Further experience along this line is needed.

SUMMARY

The case history has been presented of a patient having a large intrathoracic goiter on the right which was removed transpleurally. This approach was selected because of the fact that the patient had had three previous operations on the neck including a longitudinal division of the sternum. The large size of the intrathoracic goiter together with the suspected presence of dense adhesions were thought to constitute indications for this approach. The results were entirely satisfactory.

It is urged that intrathoracic goiters in general be removed from above and that only under very exceptional circumstances should such an approach as this be contemplated.

Some anatomic and general considerations on the subject of intrathoracic goiter are reviewed.

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ESOPHAGOTRACHEAL FISTULA DUE TO NONPENETRATING CRUSHING INJURY

COMMANDER HERBERT D. ADAMS AND COMMANDER ROY E. MABLEY
MEDICAL CORPS, U.S.N.R.

ESOPHAGOTRACHEAL fistulas are chiefly due to (1) congenital anomalies of the anatomic structures; (2) ulcerating lesions, usually carcinomatous, eroding from one structure to the other; or, rarely, (3) penetrating wounds of the thorax. A fourth and unusual cause of such a fistula is here presented in a case report in which is described some of the difficult problems encountered in saving a patient's life and in curing this type of fistula.

REPORT OF A CASE

History.—A youth, aged 19 years, was admitted in critical condition Dec. 12, 1944. Shortly before admission he was struck on the chest by a 700-pound box which had fallen from a height of ten feet.

Examination.—The patient was in profound shock; he was dyspneic and cyanotic, and there was pronounced laryngeal stridor. The only evidence of external injury was a small abrasion at the left sternal border level of the second interspace. There was no evidence of hemothorax or tension pneumothorax. There was no subcutaneous emphysema over the thorax, but there was extensive emphysema of the neck extending well over the sides of the face.

Diagnosis.—The diagnosis of mediastinal emphysema with extension to the larynx, with laryngeal obstruction, seemed clear.

Treatment.—Treatment for shock by administration of plasma was instituted at once. This was followed by blood transfusions as soon as was possible.

A tracheotomy was performed immediately under local anesthesia. The patient was placed in an oxygen tent, and 20,000 units of penicillin were given every three hours intramuscularly. Almost at once it was observed that fluids taken by mouth were coughed out through the tracheotomy tube; therefore, all intake by mouth was discontinued and fluids were given entirely by the intravenous route.

Postoperative Course.—During the next few days the patient remained in critical condition but the only new development was a traumatic pneumonitis of the left lower lobe. Hemothorax, effusion or pneumothorax did not develop. There was n severe persistent cough with considerable mucopurulent discharge through the tracheotomy tube, requiring almost continuous aspirations with suction.

The emphysema of the neck and associated edema of the larynx gradually subsided, and ten days after injury there was sufficient return of laryngeal function to permit removal of the tracheotomy tube.

Inasmuch as any attempt to swallow fluids or even saliva produced severe and prolonged paroxysms of coughing and regurgitation through the tracheotomy wound, a Levine tube was inserted through the nose into the stomach. Feeding was accomplished by this method for the next ten days, but it did not prove satisfactory, because the presence of the tube seemed to aggravate the edema and irritation in the throat and to increase the cough.

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The opinions and assertions contained in this article are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

Gastrostomy.—On the twentieth postoperative day, a simple gastrostomy was done under local anesthesia. When regular feedings were established by the gastrostomy tube, the patient's general condition improved somewhat, but the severe exhausting paroxysms of coughing persisted.

Preoperative Findings.—Bronchoscopy and esophagoscopy revealed a large esophagotracheal fistula just above the level of the carina. Because the general nutrition was being maintained satisfactorily and because of the gravity of a surgical excision of such a fistula, conservative treatment was continued in the hope of spontaneous closure of the fistula. The severe paroxysms of coughing continued, however, causing loss of rest and strain, and the patient began to lose ground gradually. It also became obvious that a spontaneous healing of the fistula was not going to take place and that operative intervention was indicated.

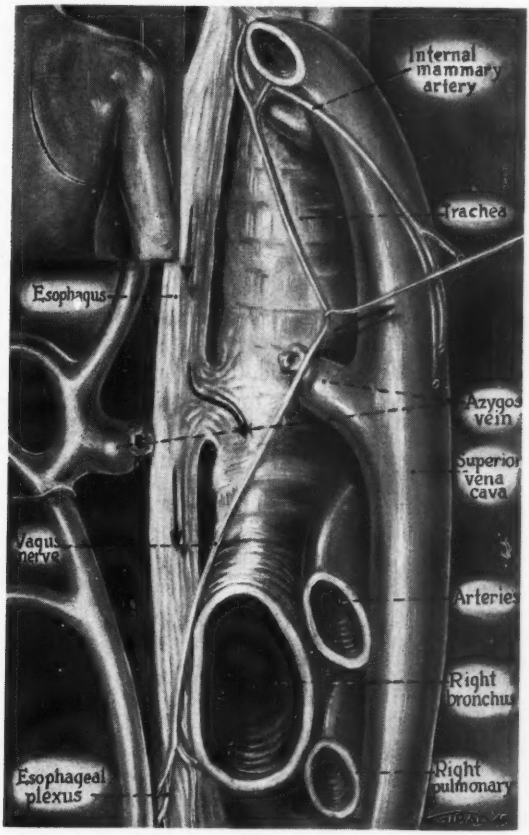

Fig. 1.—Exposure obtained at operation of the esophagotracheal fistula by right transthoracic approach.

Excision of Fistula.—Approximately four months after injury, a transthoracic excision of the fistula was performed as follows:

1. The right side of the thorax was opened through a posterolateral incision and the sixth rib was removed. The pleural space was found to be completely obliterated by adhesions.
2. Only the upper lobe was mobilized and retracted anteriorly and inferiorly.
3. The azygos major vein was ligated and sectioned and the upper mediastinal pleura opened.

4. The esophagus and trachea were mobilized and the fistula was exposed and excised.

5. The openings in the membranous aspect of the trachea and the esophagus were carefully closed with double layers of fine interrupted silk sutures.

6. Penicillin, 100,000 units, was sprayed into the mediastinum and pleural cavity and the mediastinal pleura closed.

7. The upper lobe was re-expanded and the thorax closed without drainage.

8. The penicillin dosage was increased to 30,000 units every three hours, intramuscularly.

Recovery.—Postoperative recovery was entirely uneventful. The upper lobe remained expanded, and there was no effusion or residual infection. The cough cleared rapidly and the patient was able to eat a full normal diet at the end of two weeks. He was allowed to be up at this time and the gastrostomy tube was removed. The administration of penicillin was discontinued. Approximately 22 million units had been given over a period of 138 days. The patient gained weight and strength rapidly and was entirely asymptomatic on discharge.

COMMENTS

The case reported is of interest for several reasons:

1. The extreme elasticity of the thorax was strikingly demonstrated. The impact to the anterior thoracic wall was severe enough to produce a deep-seated laceration in the adjacent walls of the trachea and esophagus without any demonstrable fracture of the ribs, sternum or cartilages.

2. It has long been well recognized that the esophagus may be the source of the most virulent types of mixed infection (mouth flora) either in connection with surgery of this structure or from penetration or laceration with a resulting fulminating mediastinitis. In this instance, infection was completely controlled by the constant use of penicillin throughout the posttraumatic and operative periods, when the esophagus opened wide into the mediastinum.

3. Complete cure without postoperative complications resulted from the following procedure: (a) a transpleural approach to the esophagus through the right side of the thorax; (b) ligation and sectioning of the azygos major vein, giving a wide exposure with excellent mobilization of the esophagus and trachea; (c) meticulous closure; (d) adequate use of penicillin.

AN ACCESSORY INSTRUMENT TRAY

BEATRICE H. AUFSES, NEW YORK, N. Y.

WITH a patient in the latericumbent position for operations such as thoracoplasty, pneumonectomy, lobectomy, sympathectomy, and nephrectomy, the rounded surface of the hip is a convenient site for the placing of instruments during their interchange between the surgeon and the instrumenteer. Because of the contour of the hip, such instruments frequently fall to the floor. In order to avoid this, a simple accessory tray* has been devised (Fig. 1).

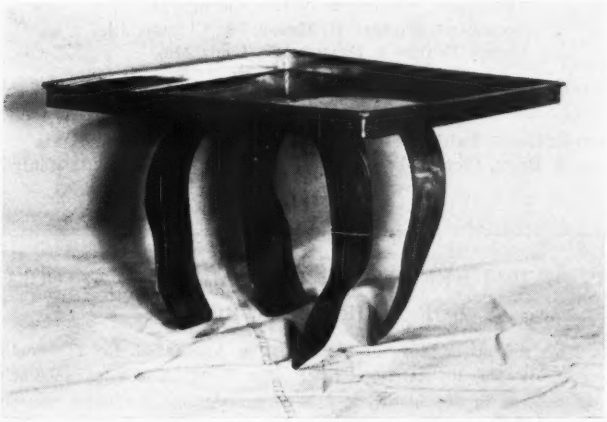

Fig. 1.

Fig. 2

The tray is made of stainless steel, with rolled edges; it is clamped to the hip or the thigh of the patient, thereby affording a flat surface. The clamps, made of special-tempered copper, are pliable and, therefore, can be adjusted to fit adults of any size. The tray is used under the sterile drape sheet, eliminating sterilization (Fig. 2). If desired, however, it can be sterilized, either by boiling or by autoclaving.

Received for publication Nov. 8, 1945.

*Manufactured by The National Surgical Supply Company, 458 Broadway, New York, N. Y.

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REPORT OF 1946 MEETING OF THE AMERICAN ASSOCIATION FOR THORACIC SURGERY

THE twenty-sixth annual meeting of the American Association for Thoracic Surgery was held in Detroit, May 29, 30, and 31 at the Statler Hotel. The attendance at the scientific sessions was the largest in the history of the organization. An extra session, under the auspices of the Detroit members, was held at the Herman Kiefer Hospital on June 1 and was well attended.

The following officers were elected for the year 1946-1947:

President, Dr. I. A. Bigger, Richmond, Va.
Vice-President, Dr. Alton Ochsner, New Orleans, La.
Treasurer, Dr. William E. Adams, Chicago, Ill.
Secretary, Dr. Richard H. Meade, Jr., Chicago, Ill.
Editor, Dr. Evarts A. Graham, St. Louis, Mo.

The following members were elected to the Council: Dr. D. C. Elkin, Atlanta, Ga., to fill the unexpired term of Dr. Alton Ochsner, Dr. Claude S. Beck, Cleveland, Ohio, to succeed Dr. F. S. Dolley, and Dr. C. A. McIntosh, Montreal, Canada, to succeed Dr. Robert Janes.

Dr. Ethan Flagg Butler, 956 W. Water St., Elmira, N. Y., will continue as Chairman of the Membership Committee.

The following Active Members were transferred, at their own request, to the Senior list:

Dr. J. Burns Amberson
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Dr. David H. Ballon
Dr. Ralph Boerne Bettman
Dr. Ethan Flagg Butler
Dr. Dean B. Cole
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Dr. William B. Faulkner
Dr. Fraser B. Gurd
Dr. Stuart W. Harrington
Dr. John N. Hayes
Dr. Peter Heinbecker
Dr. Walter Estell Lee
Dr. Ambrose L. Lockwood
Dr. J. Arthur Myer
Dr. George G. Ornstein
Dr. Edward N. Packard
Dr. Otto C. Pickhardt
Dr. J. J. Singer
Dr. David T. Smith

The following Associate Members were elected to Active Membership:

Dr. Ralph Adams
Dr. Clifford D. Benson
Dr. Reeve Betts
Dr. A. Lincoln Brown
Dr. J. Maxwell Chamberlain
Dr. O. Theron Clagett
Dr. Frank P. Coleman
Dr. J. Claude Day
Dr. Richard H. Dieffenbach
Dr. Adrian A. Ehler
Dr. Paul Gebauer
Dr. Robert E. Gross
Dr. Cranston W. Holman
Dr. Julian Johnson
Dr. Robert Laird
Dr. Charles W. Lester
Dr. N. Logan Leven
Dr. Dudley E. Ross
Dr. Vernon D. Schaffner
Dr. Robert R. Shaw
Dr. George N. J. Sommer
Dr. John D. Steele
Dr. Richard H. Sweet
Dr. M. Dawson Tyson
Dr. William L. Watson
Dr. Robert H. Wylie

The following men were elected to Associate Membership:

Dr. Osler Abbott
Dr. Arthur Aufses
Dr. Charles Philamore Bailey
Dr. Benjamin Burbank
Dr. Thomas H. Burford
Dr. Francis R. X. Byron
Dr. Andre Cournand
Dr. Arthur J. Cracovaner
Dr. Anthony R. Curreri
Dr. J. Emerson Dailey
Dr. Rollin A. Daniel, Jr.
Dr. John M. Dorsey
Dr. George H. Humphreys
Dr. Archibald R. Judd
Dr. Earle B. Kay
Dr. Edward M. Kent
Dr. Conrad R. Lam
Dr. Rubin Lewis
Dr. Clayton Lyon
Dr. Lachlan MacPherson
Dr. Laurence Miscall
Dr. Daniel A. Mulvihill
Dr. James D. Murphy
Dr. Francis J. Phillips
Dr. J. Karl Poppe
Dr. Paul W. Sanger
Dr. Lawrence Milton Shefts
Dr. Frank I. Terrill
Dr. Thomas F. Thornton, Jr.
Dr. Donald J. Tillou
Dr. Marion Lawrence White, Jr.
Dr. George Willauer
Dr. Norman J. Wilson
Dr. Thomas B. Wiper

Article II, Section 4, of the By-Laws, dealing with absence from meetings, was amended to read as follows:

> Attendance at Annual Meetings and participation in the scientific programs shall be optional for all Honorary and Senior Members, but it shall be expected from all Active and Associate Members.

Article IV, Section 7 was amended by changing the word four to the word three in relation to "consecutive annual meetings." The amended section now reads:

> The Council shall recommend that any member whose dues are in arrears for two years, or who has been absent, without sufficient excuse, from three consecutive annual meetings, shall have his membership terminated.

Article VI, Section 2 was amended by the inclusion of the following sentence, as the next to last sentence in the section:

> This Committee is also charged with maintaining a record of membership attendance and participation in the scientific programs and reporting to the affected members and to the Council any deviations from the requirement of Article II, Section 4, of these By-laws.

Dr. Carl Eggers, Chairman of the Committee appointed to consider the question of the Certification of Chest Surgeons, reported to the Association on the findings of the committee. The following resolutions were adopted:

1. *Be it resolved,* that the American Association for Thoracic Surgery recognize the American Board of Surgery as the parent organization which should properly be in control of all matters pertaining to the training and certification of surgeons and surgical specialists; and

2. *Be it further resolved,* that the American Association for Thoracic Surgery apply to the Secretary of the Advisory Board for Medical Specialties asking that a subsidiary board to the American Board of Surgery be approved for certification in thoracic surgery, and

3. *Be it further resolved,* that the Council appoint a committee composed of surgical members of the American Association for Thoracic Surgery to confer with the American Board of Surgery for the purpose of working out details.

4. That the Treasurer be authorized to spend sufficient money up to $500 for the consummation of the project.

The Rose Lampert Graff Foundation has again offered a prize of $250 for the best article, dealing with the chest, submitted to the Prize Committee before Jan. 15, 1947. If the Committee decides a paper is worthy of the award it will be placed on the program of the annual meeting and published in the JOURNAL. The competition is open to everyone regardless of nationality but the article must be written in English. The Chairman of the Rose Lampert Graff Prize Committee is Dr. Frank B. Berry, Bellevue Hospital, New York.

Applicants who wish their articles considered for the program of the American Association for Thoracic Surgery meeting should send comprehensive abstracts of their articles in quadruplicate to the Secretary, Dr. R. H. Meade, Jr., 55 E. Washington St., Chicago 2, Ill., before Jan. 15, 1947.

The 1947 meeting of the Association will be held in St. Louis on May 28, 29, and 30. Headquarters will be the Hotel Jefferson, 12th Boulevard at Locust Street, St. Louis 3, Mo. It is important that reservations be made early. Because of the crowded condition of all hotels the management has been unwilling to reserve definitely more than 200 rooms and has requested that as many as possible of the members and guests share their rooms. Other near-by hotels can probably take care of a considerable overflow.